April 1957

Agriculture

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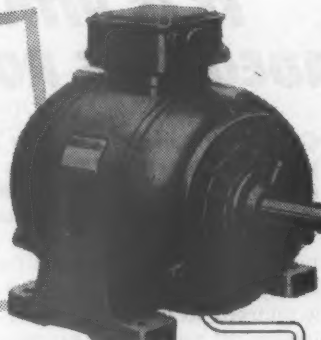

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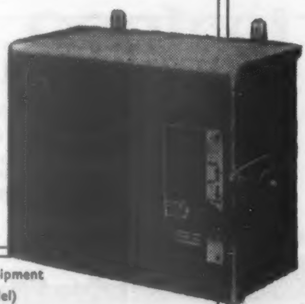

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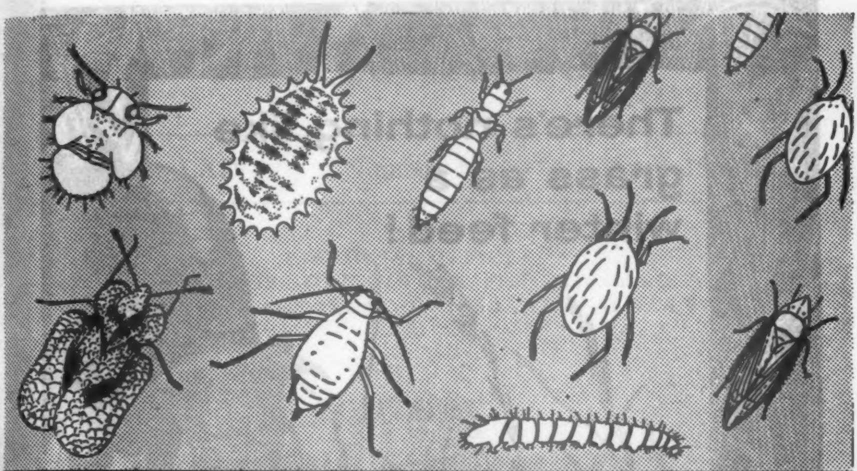

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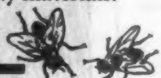

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Agriculture

Volume LXIV Number 1 April 1957

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Sheep and shadows

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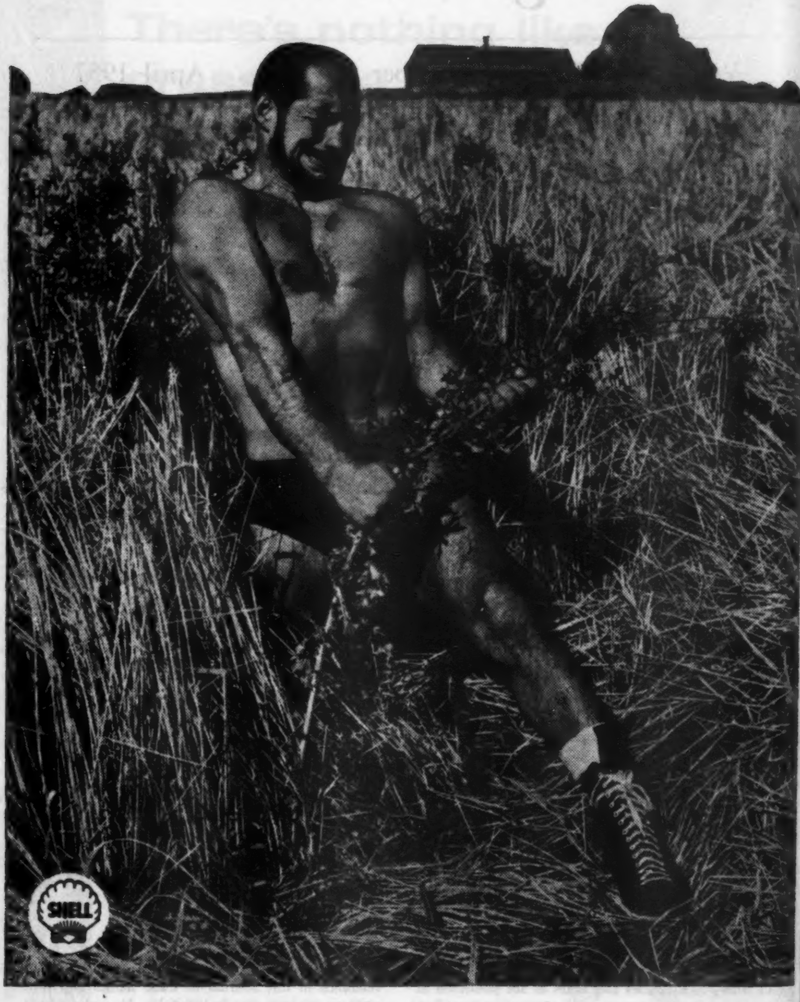

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Looking over Europe's Hedges

GEORGE GOODMAN

United Kingdom Liaison with the Food and Agricultural Technical Information Service (FATIS) of O.E.E.C.

A HABIT so ingrained as looking over the hedge at the other fellow's farming is bound to be reflected in the workings of any organization concerned with the improvement of farming and the farmers' life. Not only is this usually profitable habit reflected in the operation of the Food and Agriculture Technical Information Service of O.E.E.C., it is the very life-blood of its existence. But with this difference—the hedges are down; for the seventeen member countries of the Organization, together with the associate members (U.S.A. and Canada), Yugoslavia and Spain, have agreed to exchange whatever agricultural knowledge and experience are at their disposal. Such exchange operates not only in the realm of scientific and technical information, but in the immediately practical field of those methods, techniques and aids by which the farm advisory services are helping to re-shape agriculture. To this end, a periodical unique in agricultural literature has been promoted, namely, the *FATIS Review*, to furnish an international channel of information to all agricultural advisory and allied workers in the O.E.E.C. countries on the ways and means their colleagues have devised to shorten the time-lag between the findings of science and their application to practice.

Three times a year this *Review* publishes valuable Supplements devoted to some special aspect of European agriculture or agricultural advisory work. The latest of these concerns "Problem Areas in European Agriculture ".

Fortunately, the original concept of this Supplement was abandoned early in its history. The Editor reveals that it was first planned to be a survey, with each country describing its problem areas in some detail. Such a compilation of " hard-luck stories ", however real and tragic the thwarted lives behind them, would doubtless have evoked some sympathy, but also would probably have bred pessimism and not helped anyone very much. By a change of plan, whereby countries have given brief accounts of selected problem areas and devoted their main contributions to a description of pilot programmes and other measures directed at their alleviation, the results conjure admiration and inspire a spirit of optimism. Moreover, there is something of practical value for almost everyone in these recitals of ways and means by which so many of Europe's depressed farming peoples have been given a new life and a new outlook. This is looking over the hedge with profit.

What is a problem area?

The French contribution on Brittany lists three typical conditions:

(*a*) The standard of living fails to improve. This must be considered against the background of the contemporary social revolution: the farmer and farm worker are no longer content to accept a standard of life below that of the urban populations.

(b) The proportion of marginal holdings is high. This is wider than merely the inherent low fertility of some soils and climatic difficulties: it raises the whole question of agricultural structure—the holdings that are too small, however good the soil, and the dilemma of fragmentation in an age of mechanization.

(c) Before progress can be made, the whole economy of the area must be overhauled.

Such conditions are the common background of underdeveloped areas, and the existence of such areas in a country almost inevitably exerts an influence on the economic and social well-being of the country as a whole. This interdependence extends still further: the prosperity of a country can affect conditions throughout a whole continent. Accordingly these problems command attention among the problems of European co-operation.

Every country has its problem areas, and groups of countries in Europe have certain problems in common. In the Mediterranean countries, for example, large areas of land are at present unsuitable for cultivation because of soil erosion, inadequate water supplies and excessive heat. Added to these factors are often lack of capital and a sense of apathy, which derives in large part from the absence of instruction and education. Educational difficulties are found in all countries.

Sweden, Norway and Iceland, on the other hand, have territories in the far north and at high altitudes, where the climate is excessively cold. Mountain farming presents special difficulties in Austria, France, Germany, Greece and Switzerland. Hill farming produces marginal conditions almost everywhere.

In Germany, Austria and all countries where the laws of inheritance lead to the sub-division of the farms, many of the holdings are too small for economic management, and in many areas fragmentation still further complicates their working. History accounts for many derelict areas. Not only have some places devastated by war never recovered, but in others the rapid growth of industry has drawn the younger population from the countryside, leaving behind a labour force declining in vigour.

Is it worth it?

The fundamental question—whether it is worth it—leaps to the mind time and time again on reading the descriptions of these problems which contributors have selected as illustrative of their countries. Is it worth while expensively encouraging what looks like a chancy struggle against overwhelming odds? By the nature of things the expense must be very great and continue long. But no one seems to have any doubt about the answer, which is summarized by the writer of the article on British hill-land farming. He looks at the question from the standpoint of the national balance sheet and finds these assets: first, the land itself; secondly, the capital that has been invested in the past to turn it into farm land, including the farmhouses, cottages, buildings, drainage works, roads, schools, public services and ancillary industries; thirdly, a breeding-stock of cattle and sheep much valued by lowland farmers for their breeding qualities, health and hardiness; and lastly, a race of farmers skilled in stock-raising. These assets, except the last,

cannot be reinvested elsewhere; they must be maintained or abandoned. The British government have decided that these assets are worth preserving.

Such high investments have not been made in the past in all countries; in fact, some areas have become problems because of a lack of earlier support, but chapter after chapter re-echoes the value of the human resources that are at stake, and nowhere is the answer pessimistically negative. The Supplement is the opposite—it is an affirmation of faith.

Problems of the small holding

It is obvious that agricultural structure is a problem in all countries, and especially acute in their problem areas. The critical difficulty arises at two points. There is, firstly, the holding which can absorb the labour force of the family, but because land and capital are inadequate it cannot, by local farming standards, provide a reasonable living. Secondly, when the holding is too small to absorb the available labour, the family must either change the organization and improve the management or else find a supplementary source of income.

The problem is especially serious in a country such as Austria, where 48 per cent of the farms are of 12½ acres and under. But here, as in Greece, Norway and Switzerland, the situation is aggravated by the mountainous nature of the terrain. Of the Austrian agricultural area, 65 per cent is in the mountains.

But this is not the whole story, for fragmentation still further makes economic living well nigh impossible. Nearly half the agricultural area of Western Germany is in need of consolidation.

In mountainous areas not only have a more difficult climate and bad communications to be contended with, but when a holding consists of several plots at different altitudes, it is economically almost impossible to utilize machinery. An unbalanced proportion has to be invested in buildings: marketing is more difficult, and the short growing periods, as the chapter on Switzerland points out, means that yields per unit of area are low. Is it surprising that some mountain areas have been completely forsaken?

Too much and too little

At the heart of many problem areas lie the hard climatic facts of life—Northern Europe in general has to contend with too much water and too little drainage, while Southern Europe and the Mediterranean area faces drought and insufficient irrigation.

In the Pliocene area of Southern Portugal there is too much sand—nearly 1½ million acres of it—which was overworked by too much wheat-growing in the past, so that now only the pine, the eucalyptus and the cork-oak can survive.

In Norway there is too little land that can be cultivated without difficulty; the summers in the North are too short, and the roads are too few for economic marketing. In Ireland there is too much bogland. Once there seemed to be too many people; now there seems to be too much emigration. In Brittany there are too many people, too little lime for the acid soils and too few sources of the power that might have encouraged some industrial development to provide new outlets for the over-populated holdings.

Water is the source of trouble in parts of Belgium: too much at one time of the year, and drought for the rest. In Germany the excess is of a tragic human kind—too many refugees; twelve millions to be absorbed in a territory already severely over-populated and, as a consequence, heavy social charges for the support of large numbers of old people and children. In addition, there are great areas of bogland, much of it mountain bog.

In the Netherlands it might be said that there are too many people, with an average of eight persons per holding and the highest density of agricultural population in Europe. On the other hand, production per acre is the highest in the world. The problem is mainly that of productivity but, as the writer quotes from a French colleague, "*La productivité est un question d'esprit.*" In other words, productivity is an attitude of mind and not only a matter of methods and machines. And in some areas where smallholdings are dense not only are there financial difficulties: the occupants are also cut off from what might be called the sources of mental development.

Advice and education

Throughout this Supplement the importance is stressed of adequate advisory services to enable the farmer to reap the full harvest from the many and varied forms of state action which have been devised to save his way of life. For example, in the plan for Brittany, advisory work has a key place and the farmers are setting up their own Technical Agricultural Study Centres. Ireland has instituted a special corps of Parish Advisory Agents. Switzerland goes even beyond the necessity for sound advice, instituting that no measure is more likely to lead to permanent improvement than the technical training of the young people, and education in the widest sense.

The future

Almost all the solutions propounded in this Supplement are in some way tentative and experimental. Since their success depends so greatly on achievement in the long-term not only of economic and social development, but in the last resort of human contentment, results cannot be expected quickly. Few of the many schemes have so far given appreciable results. As the Norwegian writer concludes, it takes time to pass from analysis, through planning, to accomplishment, particularly if investment requirements are heavy.

But this Supplement breathes optimism: it reflects the faith of many governments and in addition, perhaps most important of all, it reveals a stimulating, refreshing degree of the spirit of self-help.

Note: Copies of the Supplement to the FATIS Review, *Problem Areas in European Agriculture*, may be obtained from H.M. Stationery Office, price 5*s*.

Johne's Disease

T. M. DOYLE and N. H. HOLE

Veterinary Laboratory, Weybridge

This article reviews the latest developments in research on Johne's disease, and includes a *résumé* of the Complement Fixation Test.

JOHNE'S disease is a chronic contagious disease caused by the multiplication in the intestines and associated lymphatic glands of a small micro-organism—the *Mycobacterium johnei.* Cattle, sheep and goats are susceptible. Dairy cattle are particularly susceptible and the disease usually follows a severe and rapid course in those of the Channel Island breeds. It is an important disease in many parts of the world and it would appear to be causing increasing economic loss. Europe and America are heavily infected and it occurs in varying degree in Iceland, India, Africa, Australia, New Zealand and Canada.

The period of incubation (that is, time between infection and appearance of symptoms) varies widely and may be from nine months up to twelve years; the greatest number of cases occur between the third and fifth year of age and most frequently within a few weeks of calving. The age at which symptoms develop is economically important, as the heavy cost of rearing is frequently not offset by the return from milk production; and the emaciated carcass is usually of little value. The clinical disease is characterized by intermittent or persistent diarrhoea, a tight, rough coat that fades in colour, great loss of condition and death. The affected animal may live for a few weeks or for many months. The annual herd mortality from clinical infection varies between two and ten per cent but it may occasionally rise as high as twenty-five per cent. In addition to clinically affected animals, at least seventeen per cent of apparently normal cattle carry the causal organism in their system. The full significance of this latent infection (animals infected but normal in appearance) is not yet apparent, but it underlines the prevalence of the disease.

Young animals are more susceptible to the disease than adults; from birth onwards there is a gradual build-up of resistance, but the age at which this is established appears to be variable. The majority of infected animals contract the disease during early life, but a relatively small number coming into contact with it for the first time as adults may become infected. Many animals that contract infection as adults appear to overcome it, but some develop clinical symptoms. Field experience suggests that some animals may remain susceptible up to a considerable age. It should be remembered that the resistance of adult animals to other diseases is chiefly the result of exposure to infection during early life. Whether or not infected animals develop symptoms depends on one or more of a number of conditions—for example, calving, low nutritional plane, heavy milk yield, fluke infestation, grazing on wet, low-lying land or mineral-deficient land, etc.—in fact on any factor that may lower the natural bodily resistance to disease, and activate a latent infection. There would not appear to be any one predisposing cause common to all herds.

Because of the difficulty in controlling the disease once it has become established in a herd, stock-owners everywhere are understandably reluctant to admit its presence or to give details of their losses, so that information on its prevalence is not easy to obtain and no accurate estimate can be made of the annual financial loss. But it is beyond question that the economic loss from clinical cases, stunted growth, unthrifty stock, and reduced milk yield is a heavy burden on the industry.

Cattle: Foetal infection

It has recently been shown that the foetus of a cow in the advanced stage of the disease may carry the causal organism (*M. johnei*) in its system; and a full-time living calf from such a cow may be born infected. These calves can pass the infection by their faeces to other calves in contact with them; and presumably the congenitally infected calves and those infected by them may develop clinical disease in adult life. The recognition of this important source of infection will add considerably to the already formidable difficulties of controlling the disease.

It is not yet known if the foetuses of latently infected cows can be born infected. It is a common practice to rear the calves of clinically affected cows; indeed the slaughter of the obviously affected cow is frequently postponed so that the calf may be saved. It is now clear that this is a most dangerous practice as many calves, the progeny of affected cows or of cows that develop characteristic symptoms of the disease within a few months of calving, are infected and should not be retained in the herd. This may be the source of infection for some of the clinical disease that occurs among adult animals. The causal organism has also been found in the non-pregnant uterus, but it is not known how long it can remain alive there, or whether it can infect the foetus of the next pregnancy. The organism has been recovered from the udder of affected cows, but its presence there would appear to be relatively rare and probably occurs only in the advanced stages of the disease.

Control of the disease

The disease is usually introduced into a clean herd by a recently purchased, latently infected cow which subsequently develops symptoms. There is good evidence that a long journey and a change of diet and management frequently activates the disease in these animals. Recently purchased in-calf cows or heifers, whatever their origin, should be kept under observation for at least two months after calving; and they should be isolated at the first sign of infection, that is, slight, intermittent diarrhoea, fading colour of the coat or loss of condition. If the disease is confirmed the animal should be slaughtered. The early isolation and slaughter of the scouring cow is a valuable measure of control. As these cows are a liability and must inevitably die or be slaughtered within a short time, it is difficult to understand the general reluctance to their immediate disposal, particularly as most owners are aware that such animals spread infection on the pastures and ensure the establishment of the disease in the herd.

The disease is spread within a herd by an affected cow excreting the causal organisms in the faeces and contaminating pastures, foodstuffs and drinking water; and these organisms can survive for at least 250 days on pastures.

Other methods of spread are by congenitally infected calves and by milk contaminated by infective faeces. Any cow affected with either intermittent or continuous diarrhoea, without obvious cause, should be isolated and should be examined by a veterinary surgeon. Every calf in an infected herd should be removed immediately after birth from contact with its dam, and should be bucket fed. Special care should be taken to prevent the contamination by faeces of buckets used for feeding calves. Water troughs should be cleaned out weekly because they are often polluted with faeces and may become dangerous reservoirs of the infection. Ponds should be fenced. Drainage from cowsheds should not be allowed to run on to pastures. Manure from an infected herd should not be put on pastures.

The question of nutrition

Nutrition plays an important part in the control of the disease. It appears to be relatively difficult to set up clinical disease experimentally in an animal maintained on an adequate diet, but it is easy to do so in an undernourished animal. There is good reason to believe that the same is true under field conditions. In many herds young stock—during the age of greatest susceptibility to Johne's disease—are given an inadequate diet, particularly during the winter; and this is often obvious from their general appearance. To undernourish the growing animal is a short-sighted policy; growth is stunted and the natural defences of the body against disease are weakened. Yet it is a common practice.

It cannot be contended that adequate nutrition and good management will by themselves eliminate the disease from a herd; but an adequate diet, particularly during early life, with the strict isolation and early disposal of clinically affected cows will lessen the amount of infection and reduce the number of animals that contract the disease.

Vaccination

In France, vaccination against Johne's disease has been practised successfully for the past thirty years. In this country, trials of the vaccine were started in 1940, at Weybridge, and its safety confirmed. The vaccine consists of a small quantity of living Johne's bacilli suspended in oil. When it is inoculated under the skin it gives rise to a small, inflammatory swelling that is gradually replaced by a cold, non-painful nodule which persists for a variable length of time. It was thought at one time that so long as the nodule persisted an animal was protected, but it is now believed that protection depends on the presence of the Johne's organisms in the nodule; and this would appear to vary widely with individual animals and may apparently be for any period between fifteen and thirty months. The nodule frequently persists long after the organisms have been eliminated.

The use of vaccine is restricted to calves up to one month of age; older cattle might have contracted natural infection before vaccination; and should clinical disease occur in such animals after vaccination, the method might be brought into disrepute. The duration of protection conferred by the vaccine is not known and is difficult to determine because of a gradually developing age resistance, but it is sufficient to protect most animals during the period of greatest susceptibility; field evidence suggests it lasts for at

least 18 months. Protection would appear to depend on the presence of the Johne's organisms in the vaccinal nodule and, as these are gradually eliminated, the animal's susceptibility eventually reverts to the normal of its age group.

The vaccine has been tested with excellent results during the past ten years in Britain on a considerable number of heavily infected herds, embracing different breeds and under the varying conditions of diet and hygiene found on farms; and with further improvement in the method of preparation and more attention to its use in the field, even better results should be obtainable. It would appear from the experience gained from the field trial that clinical disease can be gradually eliminated from a herd by vaccination. It is necessary in heavily infected herds to give two or three doses of vaccine at intervals of about eighteen months or earlier if the nodule regresses, otherwise an occasional animal will develop clinical disease, usually between the third and fifth year of age. These clinical cases usually occur in animals that were vaccinated some years previously and had lost their protection and were not revaccinated at the proper interval. In vaccinated herds there must be no neglect of the usual subsidiary methods of control; particular attention must always be paid to the good nutrition of young stock and the early isolation and the disposal of the scouring cow.

Unfortunately, the close relationship between the causal organism of Johne's disease and the bovine tubercle bacillus—the cause of tuberculosis—raises an obstacle to vaccination in countries engaged in the eradication of tuberculosis by tuberculin testing. The vaccine sensitizes animals to tuberculin: and tuberculosis, because of its hazard to human health, must be given priority. It is considered advisable on this account to restrict the use of vaccine in the field.

The disease in sheep

Johne's disease of sheep is of considerable economic importance, but relatively little attention has been paid to its investigation. Its geographical distribution is, in general, similar to that of the disease in cattle. Cattle strains of the causal organism can infect sheep and sheep strains can affect cattle. The annual loss in affected flocks varies between one and ten per cent. The clinical disease usually occurs between three and five years of age and usually shortly after lambing or weaning. There is great loss of condition, the wool is harsh and pulls out easily, and diarrhoea, though not a constant symptom, may occur. Loss of condition in sheep is almost invariably attributed to parasitic infestation, so when Johne's disease occurs it is usually overlooked and may become established in a flock before it is recognized. When there is an annual mortality from a chronic wasting disease in *adult* sheep, Johne's disease should always be suspected. Vaccination of sheep is extensively practised in Iceland and gives excellent results; and as sheep are not subjected to tuberculin testing, there is no obstacle to its use, provided the losses justify it.

An international problem

Johne's disease is an international problem of great economic importance and urgency; and there is evidence that it is being gradually introduced into

new areas. Yet few countries evince much interest in either its control or investigation; they appear resigned to a policy of *laissez faire*. It occupies a peculiar position among the major animal diseases. The investigation of other diseases (Brucellosis, Vibriosis, Mastitis, Swine Fever, etc.) is being carried out in many countries, much progress is being made and the results are available to all. But apart from the considerable amount of work being undertaken in Britain and Iceland and some recently in New Zealand, there have been only a few minor investigations reported in the last twenty years from other countries. The reasons for this strange apathy are, perhaps, that the disease is not communicable to man, its investigation is unavoidably slow and costly, and it is beset with many technical difficulties. But against that must be set the benefit that bringing it under control would confer on the cattle industry—indeed, it would be a major contribution to the prosperity of that industry. The answer to the problem lies in more research work; and if reasonable progress is to be made, each infected country must make a fair contribution to a general effort.

As the position stands, there is unlikely to be any marked improvement in the foreseeable future—and the only alternative to more research work is to allow the disease to continue unchecked and to endure the present heavy annual loss.

Complement fixation test

The complement fixation method of diagnosis is commonly referred to today as "the blood test for Johne's disease". Animals infected with the disease produce in their blood stream a substance called the antibody, and the complement fixation test is a complicated serological reaction which determines the presence or absence of Johne's antibody in the animal's blood. The fact that this particular test will obtain in this disease has been known for over forty years, but until recently no serious effort has been made to put this knowledge to practical use, partly on account of the complicated nature of the test, partly because of the high hopes entertained for many years for the ultimate production of an effective and more easily applied "johnin" (comparable to tuberculin), and partly owing to a cross reaction being given by animals affected with bovine tuberculosis, a common condition at the time of the original observation.

Research work at Weybridge

A few years ago, at the Ministry's Central Veterinary Laboratory, Weybridge, research work was commenced to determine the practical possibilities of the test as a weapon to use in the struggle against Johne's disease. The technical aspects of the test have been investigated and modified, and experiments (which are still in progress) inaugurated on a considerable scale to determine its accuracy and the possibility of using it to eradicate the disease from affected herds. Although these experiments have not yet been concluded, over 100,000 tests have been carried out, and sufficient confirmatory evidence has been obtained to permit some conclusions being drawn regarding the value of the test.

In common with almost every other known test of a similar nature, it is not infallible, but there seems to be very little doubt that it is the most

accurate test that has yet been applied to the diagnosis of this disease in the living animal, in so far as it picks out more infected animals than any other known test. The assessment of the degree of accuracy is not a simple matter; the only reliable method of determining the presence or absence of infection is to slaughter the animal and to carry out a thorough post-mortem examination and extensive cultural work. Not only is the cow an expensive animal to submit to such experimental procedures, but it is frequently not practical to carry out such work at the place of slaughter. Data have been collected at Weybridge by arranging for selected specimens of tissue from the slaughtered animals to be sent there for examination, a middle course which makes positive post-mortem findings a certainty but leaves the negatives open to question. The value of any such figurative assessment is dependent on the total number examined, but it is reasonable to quote percentages from the first 2,000 cases. Eighty-eight per cent of the animals found to be infected by the above procedure were positive blood reactors before slaughter; only 5 per cent were definitely blood-negative. On the other hand 28 per cent of the specimens in which infection was not demonstrated had come from animals which at some time had reacted, in many cases just prior to slaughter.

Although on the positive side the figures are very satisfactory, the negative findings are disturbing; neither positive nor negative figures, however, can be taken entirely at their face value. The method of obtaining confirmatory evidence makes it possible that some infected animals with negative blood have been missed, or that the negative findings in some of the blood-positive animals were consequential on the methods used. It should be remembered that the great majority of this evidence has been collected from infected herds; in a few herds with a clean history, all the animals have proved blood-negative. Evidence of another type suggests that in herds where clinical Johne's cases are common, the blood test is a reliable guide to future breakdowns; in a number of such herds regular testing and observation has proved this to be the case.

Value of test

Finally, what value has this test as an eradication weapon? This aspect has been under experimental observation for some three years. Results so far obtained indicate that nothing is to be gained from regular herd testing unless reactors are to be immediately eliminated. Such a policy appears at the present stage to have been successful in a number of herds, in so far as clinical disease no longer occurs, and the herds are now testing nearly or completely negative. In some herds it appears to have failed, as new blood reactors continue to crop up. Further observation and a detailed analysis of the results are necessary before judgment can be passed, but in any event the clearance of the disease from an infected herd by blood testing would require courage, patience, and perseverance.

Cider Apples

A REVISED LIST OF RECOMMENDED VARIETIES

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and

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This list is based on reports prepared for the Cider Advisory Committee of the Long Ashton Research Station.

A LIST of cider apple varieties recommended for planting was published in the 1947 Annual Report of Long Ashton Research Station and the June 1948 issue of *Agriculture*. This list, compiled by the Cider Advisory Committee of the Research Station, represented the views of various bodies interested in cider-making and cider orcharding regarding suitable varieties to grow to meet post-war needs, and was based on the best information then available.

During the past nine years further information regarding the orchard performance of these recommended varieties has been collected, chiefly from the trial orchards planted by Long Ashton Research Station in the cider-apple growing areas, and it is now apparent that some changes in the list are desirable. Certain varieties, while of good vintage quality, have not performed significantly well in the trial orchards to warrant continued recommendation for general planting, while others, about which little information was available in 1948, are now considered to show sufficient promise for inclusion in the list.

The revised list, given in Table 1 on page 12 is divided into two main groups—A and B; and Group A is further sub-divided into two categories:

GROUP A. RECOMMENDED VARIETIES. This group comprises two categories:

Category 1. Varieties of proved merit recommended for general planting in most cider-apple growing areas. They have been widely grown and are of good performance under average farm orchard conditions. These varieties should form a basis for any new orchard.

Category 2. Varieties that show promise in certain areas (given in brackets) but which cannot be recommended for general planting without further trial.

GROUP B. VARIETIES FOR SPECIAL PURPOSES. These varieties have some disadvantages but also certain outstanding qualities (given in brackets) which commend them for special purposes.

The varieties Sweet Alford, Tardive Forestier, Improved Foxwhelp and Backwell Red have been omitted from the revised list chiefly on account of their poor cropping records in certain localities. Many will regret the relega-

TABLE 1

Recommended lists for general and limited planting

Group A	*Recommended varieties*			
Time of Fall	*Category 1* (*recommended for general planting*)		(*varieties that show promise*) *Category 2*	
1st Season; before 10th October			Breakwell's Seedling	Bittersharp (Mon) (Heref.)
			Néhou	Bittersweet (Heref.)
			Reine des Hâtives	Sweet (Heref.)
			White Norman	Bittersweet (Heref.)
2nd Season; 10th to the end of October	BULMER'S NORMAN	Bittersweet		
3rd Season; 1st–20th November	COURT ROYAL	Sweet	Brown Snout	Bittersweet (Heref.)
	SWEET COPPIN	Sweet	Lavignée	Bittersweet (Heref.)
	TREMLETT'S BITTER	Bittersweet	Michelin	Bittersweet (Heref.)
	YARLINGTON MILL	Bittersweet	Northwood	Sweet (Devon)
			Porter's Perfection	Bittersharp (Som)
4th Season; 20th November onwards	ASHTON BROWN JERSEY	Bittersweet	Fillbarrel	Bittersharp (Som)
	CHISEL JERSEY	Bittersweet	Harry Master's Jersey	Bittersweet (Som)
	DABINETT	Bittersweet	Sandford Jersey	Bittersweet (Som)
			Vilberie	Bittersweet (Heref.)

Group B	Varieties for special purposes		
2nd Season	Brown's Apple	Sharp	(sharp)
3rd Season	Kingston Black	Bittersharp	(vintage quality)
4th Season	Crimson King	Sharp	(good orchard behaviour—sharp)
	Medaille d'Or I (Spreading)	Bittersweet	(very late-flowering)
	Stoke Red	Bittersharp	(late-flowering and vintage quality)

Some varieties are self-sterile and all varieties crop better when cross-pollinated. For details see Table 2.

tion of Kingston Black to the list of varieties for special purposes, but the poor cropping and susceptibility to disease of this variety have made this necessary. Another vintage quality apple, Stoke Red, has suffered a similar fate; although it crops well, the small fruit size of this variety is a strong disadvantage under present-day conditions owing to the extra labour cost entailed in harvesting operations. It is still a useful apple to plant under certain conditions, particularly on frosty sites, where its late flowering is advantageous, and it has consequently been included in the list of varieties for special purposes.

The only addition to the list of varieties recommended for general planting is Chisel Jersey, a variety which is known to do well in many of the cider-apple growing counties. No true sharp varieties occur in Group A of the new list, though a number of bittersharp varieties are included. The absence of sharps is due to the lack of demand for this type of apple in some cider-making districts.

In the 1948 list the recommended varieties were arranged according to juice classification (sweet, bittersweet, etc.) and cider-making season. In the present list the arrangement has been altered, the varieties being grouped according to time of fruit-fall in the orchard, a change which reflects recent developments in orchard planning and management. Whereas in the past, varieties of quite different seasons were planted together, in the best modern cider orchards the varieties are grouped according to time of fruit-fall so that whole sections of the orchard may be harvested at the same time. This helps with labour, and also, as most cider orchards are grazed, provides a longer season of usefulness for the cattle who share the orchard with the cider-apple trees.

Suitable pollinators

Another factor of importance in planning a cider orchard is the provision of suitable pollinators. This question did not arise in the older type of farm orchard containing a large mixture of interplanted varieties, but has arisen as a result of the modern tendency to plant relatively few varieties in blocks, many of which will set only poor crops with their own pollen. Moreover, not all varieties are equally good as pollinators for other varieties, and some, such as Bulmer's Norman and Court Royal, are quite useless. For this reason, advice on the choice of suitable pollinator varieties has been included in Table 2, which also summarizes the available information on the blossoming season, size and habit, and orchard behaviour of all the varieties listed in Table 1. The varieties of proved merit given in Table 1 do not provide a wide choice of harvesting season, and it is desirable to find varieties to fill the gaps. The list is thus not to be considered as a final one. Many of the varieties that show promise in certain areas have yet to be tried elsewhere and, as more information on these and other varieties becomes available, the list recommended for general planting will be lengthened.

The new list has been prepared by the Cider Advisory Committee of the Long Ashton Research Station, consisting of representatives of the Research Station, the National Farmers' Union, the National Association of Cider Makers, the Bath and West and Southern Counties Society, the National Agricultural Advisory Service and the County Councils of Devon, Dorset, Gloucestershire, Herefordshire, Monmouthshire, Somerset and Worcestershire.

TABLE 2

Variety	Season of blossoming	Suitable pollinators* (see 1st column)	Self-fertility
1. Ashton Brown Jersey	4th	3, 6, 9, 10, 11, 12, 15, 17, 22, 25, 21, 2, 16, 18, 19, 26	
2. Breakwell's Seedling	3rd	16 18, 19, 26, 1, 3, 6, 9, 10, 11, 12, 15, 17, 22, 25, 26	
3. Brown's Apple	4th	1, 6, 9, 10, 11, 12, 15, 17, 22, 25, 21, 2, 16, 18, 19, 26	
4.†Brown Snout	6th	14, 24, 21	
5. Bulmer's Norman	2nd	2, 16, 18, 19, 26, 13, 23	Poor
6.†Chisel Jersey	4th	1, 3, 9, 10, 11, 12, 15, 17, 22, 25, 21, 2, 16, 18, 19, 26	Fair
7.†Court Royal	2nd	2, 16, 18, 19, 26, 13, 23	Poor
8. Crimson King	2nd	2, 16, 18, 19, 26, 13, 23	Poor
9. Dabinett	4th	1, 3, 6, 10, 11, 12, 15, 17, 22, 25, 21, 2, 16, 18, 19, 26	Good
10. Fillbarrel	4th	1, 3, 6, 9, 11, 12, 15, 17, 22, 25, 21, 2, 16, 18, 19, 26	
11. Harry Master's Jersey	4th	1, 3, 6, 9, 10, 12, 15, 17, 22, 25, 21, 2, 16, 18, 19, 26	
12. Kingston Black	4th	1, 3, 6, 9, 10, 11, 15, 17, 22, 25, 21, 2, 16, 18, 19, 26	Fair
13. Lavignée	1st	23	
14. Médaille d'Or I	7th	4, 24	Good
15. Michelin	4th	1, 6, 9, 10, 11, 12, 17, 22, 25, 21, 2, 16, 18, 19, 26, 3	Good
16. Néhou	3rd	2 18, 19, 26, 1, 3, 6, 9, 10, 11, 12, 15, 17, 22, 25, 26	
17. Northwood	4th	1, 3, 6, 9, 10, 11, 12, 15, 22, 25, 21, 2, 16, 18, 19, 26	
18. Porter's Perfection	3rd	2, 16, 19, 26, 1, 3, 6, 9, 10, 11 12, 15, 17, 22, 25, 26	
19. Reine des Hâtives	3rd	2, 16, 18, 26, 1, 3, 6, 9, 10, 11, 12, 15, 17, 22, 25, 26	
20. Sandford Jersey			
21. Stoke Red	5th	14, 24, 1, 3, 6, 9, 10, 11, 12, 15, 17, 22, 25	Fair
22. Sweet Coppin	4th	1, 3, 6, 9, 10, 11, 12, 15, 17, 25, 21, 2, 16, 18, 19, 26	Good
23. Tremlett's Bitter	1st	13	Poor
24. Vilberie	6th	4 14, 21	
25. White Norman	4th	1, 3, 6, 9, 10, 11, 12, 15, 17, 22, 21, 2, 16, 18, 19, 26	
26. Yarlington Mill	3rd	2, 16, 18, 1, 3, 6, 9, 10, 11, 12, 15, 17, 19, 25	Fair

* Bulmer's Norman, Court Royal and Crimson King are useless as pollinators.

† With these varieties, it is particularly important to ensure that the correct variety is secured, since there are other sorts also passing under these names. Where there is any doubt, reference should be made to the Research Station, Long Ashton, Bristol.

Varietal characters

Size and habit of tree	Notes on orchard behaviour
Medium, semi-spreading	
Medium, semi-spreading	Fruit should be harvested promptly.
Medium, upright	
Medium, upright	Trees liable to split at crotch.
Large, spreading	Generally healthy. Usually biennial, trees liable to split at crotch.
Medium, spreading	Fruit size variable.
Large, spreading	Generally healthy. Usually biennial, trees liable to scab and brown rot.
Large, semi-spreading	
Small, spreading	Needs good growing conditions.
Small, semi-spreading	Fruit often small.
Medium, semi-spreading	
Medium, semi-spreading	Subject to scab and canker. Not a heavy cropper.
Small, semi-spreading	
Small, spreading	Tree precocious and subsequent growth may be weak. Not usually suitable for a standard tree. Fruit often small.
Medium, upright	
Medium, semi-spreading	
Large, semi-spreading	
Large, spreading	
Medium, semi-spreading	Fruit often small.
Medium, semi-spreading	Needs good growing conditions.
Medium, semi-spreading	Trees are slow growing but eventually reach a fair size. Fruit often small.
Large, semi-spreading	Usually healthy.
Medium, semi-spreading	
Large, spreading	
Small, spreading	Susceptible to scab. Needs good growing conditions.
Medium, semi-spreading	

Plant Populations of Mangolds and Fodder Beet

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That maximum yields of roots per acre in terms of dry matter depend upon the right level of plant population, is emphasized by two years' work at Nottingham.

Growers of sugar beet are constantly being reminded of the advantages of maintaining the right level of plant population—a matter which, in turn, is of course, determined by row width and singling distance. Because of their greater size, the traditional varieties of mangolds are grown at appreciably lower plant populations than sugar beet, but the introduction of the newer range of varieties within the mangold-fodder beet group has necessitated a re-examination of the influence of plant population on examples of this range.

Four varieties put to the test

Considerable differences exist between varieties in respect of size and shape of root, depth of burial in the soil, dry matter content, top size and yields per acre. It seemed reasonable to presume that in view of the demonstrated influence of plant population on yields of sugar beet, a similar level of influence might apply to those varieties, such as Hunsballe, which closely resemble sugar beet in growth, whereas varieties which produced larger roots might be differently and possibly less severely affected by changes in plant populations. This idea was put to the test in trials in 1954 and 1955, using four varieties representing a range of types within the group. These varieties were Yellow Globe mangold, Barres C.B., Yellow Øtofte X, and Hunsballe X.

In 1955, in view of difficulties of seed supply, Yellow Daeno XI was substituted for Yellow Øtofte X. Planned populations of 15,000, 20,000, 25,000 and 30,000 plants per acre were attempted for each variety which, with a standard row width of 22½ inches, gave spacings from 18.6 to 9.3 inches between plants. In 1955 the standard row width was reduced to 20 inches and consequently singling distances fell within the range of 20.9 to 10.5 inches between plants. Singling was done as accurately as possible to these distances, using laths marked with the appropriate spacings but, as anticipated, the achieved populations at harvest differed slightly from the planned populations. In each case, the increase in plant population resulted in a reduction of individual root size. Generally, the smaller roots achieved by higher plant populations contained a slightly higher percentage of dry matter, and the overall yield of fresh roots was highest at the higher plant populations. Thus highest yields of dry matter were obtained in every case from populations of

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30,000 plants per acre. Yields of tops were not appreciably affected by different populations. This appeared to be primarily a varietal feature. *For example:*

Yield data from 1955 trial (via regression)

Planned Population (thousands per acre)	Yellow Globe	Barres C.B.	Yellow Daeno	Hunsballe
	Clean root yields (*tons per acre*)			
30	29.1	22.8	22.2	16.0
25	26.8	21.6	20.9	14.9
20	24.4	20.5	19.6	13.7
15	22.1	19.3	18.3	12.5
	Yield of dry matter (*cwt per acre*)			
30	62.4	63.8	69.0	68.8
25	58.3	59.7	64.9	64.7
20	54.2	55.6	60.8	60.6
15	50.1	51.5	56.7	56.5
	Yield of tops (*tons per acre*)			
30	4.0	6.0	6.7	6.8
25	3.9	6.0	6.6	6.7
20	3.9	5.9	6.6	6.7
15	3.8	5.9	6.5	6.6
	Mean dry matter percentage of roots			
	11.0	13.7	15.5	22.0
	Mean dirt tare as percentage of gross root weight			
	3.4	4.3	6.7	8.2

It is apparent that plant population has appreciable effects on both the yields of fresh root and of dry matter per acre regardless of variety. To obtain maximum yields per acre with any variety, it seems desirable to aim at a population of 30,000 plants per acre—in fact, the figure generally recommended for sugar beet. Against this are the facts that this procedure would mean more individual roots to be handled at harvest and that the roots would generally be smaller, giving a crop which would never win a root competition, but nevertheless one which would, in view of the increased dry matter per acre, prove more valuable. A reduction in row width and/or singling distance to produce the higher plant population might however increase difficulties with cultivations.

Root growing involves high costs per acre, and it is important that high yields are obtained in return. Those who remain convinced of the value of mangolds and fodder beet for stock-feeding must be conscious of the necessity of obtaining the highest yields of dry matter, rather than roots alone, and a dry matter of 20 per cent still means a succulent feed. Naturally, other features such as ease of lifting have to be taken into consideration when choosing a variety of mangold or fodder beet, but seemingly no matter which variety is chosen a high plant population is advantageous. On a practical scale there may be no great advantage in achieving as many as 30,000 plants per acre with mangolds, but in many cases *apparently* good crops of mangolds may have even less than 15,000 plants per acre—and frequently do.

No large gaps

In subsidiary trials there was evidence to support the view that gross irregularity of plant is more damaging to yield than equivalent but regular reductions in population. There is considerable latitude as far as arrangement of plants is concerned, but at any population level it is important to avoid large gaps. On the other hand, a fair proportion of doubles, at equivalent plant populations, did not appreciably affect yield; and in an irregular braird, compensation for at least the smaller gaps may be achieved by leaving doubles adjacent to the gaps.

Increased yields of roots per acre can be obtained either by increases in plant population and/or increases in individual root size, so that any factor which influences root size (for example, manuring) merits equal attention to that suggested for plant population.

These results and conclusions refer to work during two contrasting seasons, with May to October inclusive rainfalls totalling 16.1 inches in 1954 and 11.5 inches in 1955, with a particularly dry period in the latter year, during July, August and September. Nevertheless, the results over the two years are in close agreement and give no support to the suggestion that during a dry summer, high plant populations would suffer because of the more severe inter-plant competition for moisture.

Although only few representatives of the variety range were included in these trials, the medium dry matter varieties such as Yellow Øtofte and Yellow Daeno had much to commend them—clean roots which were almost as easy to lift as mangolds, and above all, highest yields of dry matter per acre, which were achieved at lower weights of fresh roots.

★ *NEXT MONTH*

Some articles of outstanding interest

Outlook for Home-grown Fruit by C. E. PEARSON ● A Case for Field Beans by M. J. WAY ● Fertilizer Practice in Hill Areas by B. WILKINSON ● The Common Rush and its Control by J. G. ELLIOTT.

Dutch House Cropping at Roden

J. DORRELL

Mr. Dorrell, who is the Group manager of the C.W.S. Provincial Farms and Nurseries, describes the highly productive cropping of vegetables at the Roden Nurseries in Shropshire. The unit, which also includes the growing of fruit, revolves round two main crops—tomatoes and lettuce.

DUTCH light cropping is already widely practised in this country, and the very high cost of fuel will, no doubt, cause many growers to re-examine the possibilities of this method when considering crop production under glass. On our Roden Nurseries we have about 1½ acres under Dutch lights, and it may be of interest to readers to see how the system works on a reasonably large scale. The two crops around which the unit revolves are lettuce from November to April, followed by tomatoes from April to October. The main annual cultivations are carried out after the tomatoes are finished and before the cycle begins once more with lettuce.

It is the Dutch lights with which we are directly concerned in this article, but I would ask you to keep in mind the background against which the vegetable section is set and that it is only one part of a highly productive unit. The Roden Nurseries consist of 16 acres of heated glasshouses, 90 per cent of which is cropped yearly with tomatoes and the remainder with cucumbers. Another 25 acres are planted with fruit, mainly apples and black currants, with some strawberries and raspberries; and a further 10 acres devoted to intensive vegetable production. The vegetable and fruit sections are both under the control of one foreman with a charge-hand on each section, and the whole area can be irrigated from the river which runs close by.

The nursery is designed largely to supply tomatoes and cucumbers to the northern and midland markets, and it cannot be denied that this has an influence on the cropping programme of the Dutch lights. We discovered early that lettuce sold much better in the spring when it could be sent out with the first fruits of the tomatoes and cucumbers, than when put on the market a few weeks earlier. Planting dates were adjusted to provide the bulk of the lettuce a little later.

There is also the question of the full and profitable employment of labour. This means that there is always a certain amount of interchange of labour between one section and another. The very fact that labour can be transferred has tended towards simplicity and concentration on a few crops.

I think it would be more accurate to describe the system we use as "Dutch house" rather than "Dutch light" cropping, although a little of the latter is still practised. This is the method which we have found to suit us best after a fairly long testing period.

It is just over twenty years since a start was made with Dutch lights. Using the most complicated cropping programmes and schedules, the intention was to grow two, three, or four crops—of infinite variety—each year, with very considerable overlapping. I would hesitate to say what really turned us away from our original ideas, but at this late date I am compelled

to admit that it must have been that least tolerant of all teachers—experience; although a good deal may be attributed to natural indolence!

A contributory factor was certainly the laying down of hotbeds on some areas to be incorporated in the system. The rapid invasion of the whole area by annual and perennial weeds which followed—particularly the dwarf nettle—soon enforced a change to a less ambitious system which has been followed with quite reasonable success for well over ten years.

The Dutch houses

I said earlier that we used mainly Dutch houses. These are made up with two lights leaning in towards each other at angles of approximately 25 deg.; two more lights form a ridge roof above and give a height to ridge of 6 feet 6 inches and 13 feet width at the base. A very simple bracket secures each angle and makes an extremely sturdy structure. Lights forming both side and ridge are bolted together to give any length of house which may be convenient, and this we find is usually around 180 feet or 284 lights. Houses are set out in blocks of parallel lines about 3 feet 6 inches apart.

Vents are provided by fitting a sliding light on alternate sides of the house in the ratio of 6:1, although I think it should be noted that we have never been entirely satisfied with ventilation obtained by this method, and must continue to look for improvement.

The houses remain on the same plot for a period of three years; that is, one-third is moved each year and the whole area is continually " marching ". It is perhaps only during the year when a block is moved that the lights can truly be said to fulfil their ideal function.

Normally, the block being dismantled for " marching " is transferred to a temporary bed as single-span, shallow frames over early lettuce, and thus cover twice the area that would be covered in the erected position. The new land is being finally prepared during this period for erection of the Dutch houses, to start the cycle again with tomatoes. Unfortunately, there are occasions, due to weather, labour, or other factors, when this period with the lights laid down as frames must be dispensed with, and we have already formulated a plan to counter this difficulty, which I shall deal with later.

A word now about the preparation of the land. The intermediate crops grown within the complete vegetable rotation are principally self-bleaching celery and cauliflowers, although a certain proportion is always down to outdoor lettuce to provide continuity. Added to this are broad beans and sundry other vegetables.

On the land intended for covering with houses we aim at growing a crop of celery in the preceding year, for several reasons. Celery is a grand crop to deal with heavy dressings of farmyard manure and also keeps weeds within reasonable bounds. In addition, it will be cleared sufficiently early in the season to allow ample time for adequate cultivation and even a bastard fallow if the weather is kind enough. Farmyard manure is readily available in the district at a moderate price, although the same is unfortunately not true of stable manure. About 60 tons per acre will have been ploughed in for the celery crop, to a depth of 15 inches, using a single-furrow, one-way plough.

The normal spring cultivation within the houses consists merely of a

good deep rotary hoeing, but before this time arrives the tomatoes will already have been pricked out in soil blocks, after being sown about mid-February.

Tomatoes

After prolonged trials with varieties of tomato for cold house work, our mainstay for many years was Ailsa Craig. Moneymaker succeeded well if the season was reasonably good at planting-out time. However, for the past two years we have used Hertford Cross and, following the very cold spring of 1956, we recorded the highest-ever crop—well over 40 tons per acre.

Plants are pricked direct from seed-trays into soil blocks at the earliest possible stage and held in a temperature at or just below 50°F. Base fertilizer is applied before the final rotary hoeing; at the same time any additional potash deemed necessary is given. Tomatoes are planted from April 16 onwards, and planting will normally be completed by the month-end. This is a period of some anxiety and is one of the penalties of cold house growing. We have on several occasions registered 10 deg. of frost outside after planting-out with little apparent harm, whereas less severe temperatures appear to do much more damage in conditions of prolonged dull, cool weather. I think the explanation for this lies in the fact that weather conditions which give rise to keen night frost normally enjoy considerable sun during the day. Much of this sun heat is trapped by the glass and consequently soil temperatures will be adequate to withstand quite a severe "short-fall".

After the first truss has set, moderate watering commences. Top dressings amounting to 1 cwt per house follow at approximately 21 day intervals, and consist of a complete feed, or straight blood as the plant requires. An average of six trusses of about 1 lb each is usually obtained; the outside plants are stopped at four trusses and those under the centre going on to seven. The rather poor ventilation which was mentioned earlier often manifests itself in a more or less severe attack of *Cladosporium*, despite spraying. The resistance to this disease which these hybrids are known to possess may well account for a good deal of the success with the variety Hertford Cross.

Tomatoes cleared for lettuce

When the tomatoes have been cleared in late September or early October, the structures and the land are carefully sterilized with a formaldehyde solution, at a strength of 1:100. Preparation of the soil for lettuce usually consists of rotary hoeing to a depth of 9 inches and levelling the surface by hand. A planting board is used to preserve the surface structure, and great importance is attached to this aspect. Planted out in mid-November, the plants quickly become well established and show considerable coverage of the land before Christmas.

The aim is to obtain a well-hearted lettuce of good size and the planting distance is 8 inches×8 inches. Sufficient fertilizer is left behind from the tomato to provide ample growth. This we have proved by our inability to obtain any improvement in crop when lettuce are given extra fertilizer as a top dressing. Harrison's Glory gives the best result under most conditions,

with May Queen and May Princess succeeding well if weather conditions are not too severe. Unrivalled is also very useful.

First cutting starts about mid-March, though this, of course, is greatly influenced by the weather conditions immediately preceding.

Competition from chickweed and dwarf nettle becomes increasingly more troublesome as the soil warms up, and this often results in serious losses, particularly in quality of heart. In fact, these weeds have become such a serious problem, both as regards the labour cost for cleaning and loss of plants, that we have decided upon a rather drastic counter measure. A mobile steaming plough has been purchased, and the aim is to give a light steaming from time to time as experience will dictate.

A further refinement which is being seriously considered for the immediate future is a very light tubular steel structure to enable larger blocks with better headroom to be used. This will also ensure a bigger area covered with the same number of lights.

Whether these two factors will result in a change of system remains to be seen, but we shall remain ever vigilant in the search for an easier way to grow cheaper and better crops, using a medium which has proved over a number of years to have a great deal to commend it.

FOUL BROOD

A new Order, known as the Foul Brood Disease of Bees Order, 1957, came into operation on April 1. It supersedes the Foul Brood Disease of Bees Order, 1952.

The Order re-enacts the provisions for the examination of bees, combs and beekeeping equipment by an officer appointed by the Minister, the taking of sample combs and testing them for disease, and the issue of a notice prohibiting the removal of bees, combs, honey and equipment where foul brood is suspected. The Order also provides that if the presence of disease is confirmed, destruction of the infected bees and combs and any honey contained therein may be required and the infected equipment either treated or destroyed.

The new Order differs from the 1952 Order in the following respects: it transfers responsibility for the performance of certain formal functions from County Agricultural Executive Committees to the Minister; it prohibits the obstruction of an appointed officer in the exercise of his duties; and it enables steps to be taken immediately after failure to comply with a notice requiring destruction or treatment and not, as previously, after conviction for such a failure.

Dewponds

Nigel Harvey

Dewponds are among the more curious features of our countryside. But they are not as curious as the legends which have gathered around them. This article summarizes the evidence available on their origins, method of replenishment and construction.

NOWADAYS every rural topic has its appropriate specialist. He may be a scientist, an engineer, an economist or a member of any one of a dozen professions; his qualifications depend on the matter in hand. The appropriate specialist for dewponds, however, represents a less formal discipline. He should be an iconoclast. For the dewpond is a rather ordinary sort of pond which man has chosen to afflict with a quite extraordinary sort of mythology. This mythology first made its appearance in the later nineteenth century and its falsity was shown by experiment and observation in the early twentieth century. Its operational life, therefore, should have been short. But, like other picturesque legends, it has proved immune to the corroding influence of fact and it continues unabated to this day, bright, colourful and plausible as ever. Indeed, the modern writer can do no more than repeat what better men have said before him, consoling his readers and himself with the reflection that repetition can serve other causes than that of myth.

What is a dewpond?

It is not easy to define a dewpond. But it is fairly easy to recognize one by its essential characteristic; it is a pond without visible means of support. True dewponds are supplied neither by springs nor by streams nor by drainage. Nevertheless, though commonly on the tops or upper slopes of hills, they often continue to contain water in times of drought after lowland sources have failed. The phenomenon may possibly have started the nursery rhyme about Jack and Jill who went *up* the hill to fetch a pail of water. It certainly started the speculations that have now developed into the legends with which we are all familiar.

The origins of dewponds

The first of these legends concerns the history of the dewpond. Mythology likes its ingredients old, so we are sometimes told that dewponds date from neolithic times, when ancient men first settled on the chalk downs. This may conceivably be true; but there is no evidence whatsoever to support or to refute it. As a matter of fact, dewponds are not confined to the chalklands. Their traditional home is the Sussex Downs, but they are also found in Dorset, Berkshire, Wiltshire, Somerset and Yorkshire, generally on chalk though sometimes on limestone. But we know very little about their origins.

There is, it is true, a dewpond at Milk Hill, overlooking the Vale of Pewsey, which occupies the same site as a pond called "Oxenmere" mentioned in a Saxon charter of the year 825. But the identification of the two

ponds has been questioned on the very practical ground that if a dewpond is cleaned periodically, the clay bottoming will gradually be removed, whereas if it is not cleaned periodically it will slowly accumulate weeds until it becomes shallow enough to evaporate in a dry year, thus exposing the clay to the destructive heat of the sun. Its life, therefore, is limited unless it receives regular maintenance; and regular maintenance for a period of over 1,000 years implies an unnaturally steady succession of unnaturally conscientious farmers. So this particular case is unproven.

Our first firm evidence on the subject comes from literary sources in the eighteenth century. The earliest reference to what are now called dewponds occurs in a book published in 1743, and a generation later Gilbert White had a good deal to say about "the little round ponds of this district . . . which, in spite of evaporation from sun and wind and perpetual consumption by cattle, yet constantly maintain a moderate share of water, without overflowing in the wettest seasons as they would do if supplied by springs". And that is as far as we can go. We know that dewponds existed in certain areas of the countryside in the eighteenth century; we presume that they were made at least a lifetime before they were mentioned in print, since the early writers accept them as normal features of the countryside; we can argue, on rather doubtful grounds, that they were known in Saxon times; and we can imagine exactly what we like.

Dewponds without dew

This historical mythology, however, is a mere prologue to the major technical mythology which has developed about the dewpond. For it is widely held that the dewpond is, literally, a pond supplied by dew. There is no standard authoritative statement of this belief, but, according to the general line of argument, moisture-laden air passes over the relatively warm earth-surface of chalk or limestone until it reaches the cold pond, where condensation causes a heavy fall of dew. Some supporters of this belief hold that a clay pocket in the chalk or limestone is cold enough to cause such condensation and suggest that dewponds began as cavities scooped in the clay. Others, however, contend that the bottoming of dewponds requires insulation by straw to prevent the heat of the earth from raising the temperature of the water above condensation-point. But this is a minor difference of opinion. It does not affect the principle of replenishment by dew.

It is not easy to trace the origin of this idea. The word "dewpond" is of fairly recent origin—the *Oxford Dictionary* gives the date of its earliest recorded use as 1877—and neither Clutterbuck nor Slade who wrote practical articles on the subject in the 1860's and 1870's thought that these ponds were supplied by dew. Nevertheless, it seems clear from the paper which Professor Miall read to the British Association in 1900 that the idea was widely accepted by the end of the century and it appears in classic form in the Hubbards' book of 1907. But it is not difficult to expose the fallacy of this belief or, more accurately, to repeat the statements of the careful and responsible men who have studied and exposed it.

The first of these was E. A. Martin, F.G.S., Secretary of the South-Eastern Union of Scientific Societies, who received a grant for research into this subject from the Royal Society shortly before World War I. His principal

Photo: *Sport and General*

An example of a dewpond on the Sussex Downs

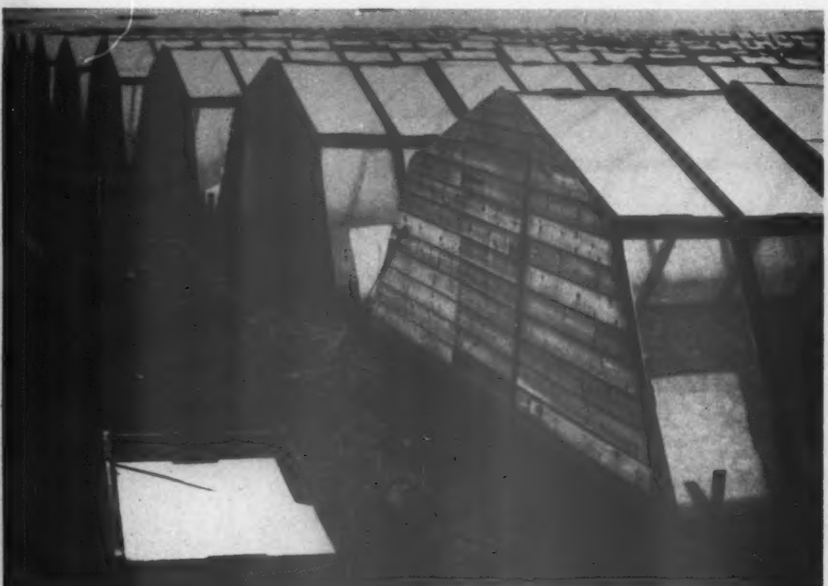
Johne's Disease (Article on pp. 5–10)

Clinical disease in a heifer.

A watery swelling under the jaw is a fairly common symptom.

Dutch House Cropping at Roden (Article on pp. 19–22)

Houses are set out in blocks of parallel lines about 3 feet 6 inches apart. Note the roof vents.



Photos: *Jacob*

A normal layout, showing houses oriented north to south.

Packaging Protein (Article on pp. 31–4)

A Dutch barn combining a pit has proved very successful.

Photos: *International Harvester Co.*

The day's ration is easily measured and loaded.

publication on the subject, *Dewponds, History, Observation and Experiment*, appeared in 1915. The second was A. J. Pugsley, M.A., B.Sc., a Bristol schoolmaster, who published his astringent and scholarly *Dewponds, Fact and Fable* in 1939. Together they make it clear that dewponds are not, and could not possibly be, ponds that are filled by dew.

Firstly, there is not sufficient dew. Various studies have been made of the average annual dew-deposit. One gives a figure of .77 inches, another a figure of .88 inches, the highest a figure of at most 1.5 inches. Dew, therefore, could not possibly be more than a very minor factor in the replenishment of a dewpond. Secondly, the temperature of the ponds is seldom low enough to cause condensation. "All known evidence," Pugsley concludes after lengthy analysis and argument, "tends to show that the surface of the ponds will be at a higher temperature than the surrounding land or air during the night." Thirdly, even if all available dew was collected by the ponds, it could not compensate for the loss of water by evaporation. The generally accepted figure for loss by evaporation from large surfaces, such as reservoirs, is 18 inches a year, and any figure of this order far outweighs any conceivable gain from dew.

The unromantic facts

Dewponds, therefore, are not filled by dew. Neither is there any reason to suppose that they are filled, as has sometimes been vaguely suggested, by fogs or mists. It seems clear that the ponds are filled by nothing more romantic than rainwater. Most of the ponds are in districts with an annual rainfall of between 30 and 40 inches, which in normal years leaves them a fair balance in hand of precipitation over evaporation even after reasonable consumption by stock. Further, the large sloping rims of the ponds make their collecting area considerably larger than their evaporating area—for most dewponds, Pugsley estimates, the ratio would be about three to one. Even in times of drought, therefore, their reserves are considerable. One set of calculations gives a pond of typical design and dimensions and an assumed consumption of 166 gallons a day, a "life" of three months if no rain fell at all. In practice, some rain falls even in bad periods of drought, so its life would be longer. And ultimately, no rain means dry ponds, for there is no truth in the tradition that dewponds never fail. In the severe drought of 1911, for instance, "a very large proportion" of the ponds observed by Martin failed, and after a three months' drought in 1921 Curwen found that 17 out of 37 ponds investigated were dry.

Construction of dewponds

All this, admittedly, has little to do with dewponds. It is solely concerned with what man has thought fit to believe about them. But there is also a considerable and varied literature on ways of building them. In theory, it seems fairly simple. In practice, it is more than complicated. Many areas and, the bewildered reader suspects, most individuals have developed their own particular ways of making these ponds; Pugsley alone lists more than twenty methods of construction. The literal basis of them all, of course, is impermeable bottoming. Traditionally, this is composed of well-beaten clay,

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though in some districts puddled chalk is used, and lime is added to check boring by worms. The idea that straw is an essential material for dewponds is probably a result of the "replenishment-by-dew" heresy which regarded it as necessary to secure proper insulation. In fact, however, it is not always used in dewpond construction, and where it is used it is apparently a means either of consolidating the clay into which it is incorporated or of covering the face of the new-laid clay to protect it from sun or frost. This impermeable bottoming is commonly covered with rubble, loose chalk or stones to prevent damage by the feet of stock.

For details the reader is referred to the previously-quoted books of Martin and Pugsley and to correspondence in the *Land Agents' Journal* for October and November 1956. From these sources he will find sufficient variations on a central technical theme to satisfy the most récherché taste in dewponds.

It may, of course, be easier and cheaper to forget inherited lore and build your dewpond in concrete. In so doing, however, you will not be breaking a tradition, you will be continuing it. For one thing, you will be following predecessors who have been making dewponds in concrete for at least half a century. For another, you will be doing what the forgotten men who first built dewponds did before you—you will be making the best use of the materials available to you. And this, surely, is the first and finest tradition of the countryside.

Holland, Denmark and Sweden Revisited

PROFESSOR A. N. DUCKHAM, C.B.E., M.A.

University of Reading

New techniques, better organization, greater mechanization, well-considered management. These were the farming factors which Professor Duckham was looking for on his visit to the Netherlands and Scandinavia last year.

IN the late 1920s I worked for some months on a farm in Denmark, travelled the length of Sweden up into the Arctic Circle, "walked" the famous permanent pastures of northern Holland and studied the pig industry of all three countries in some detail. Then in 1930 I saw something of the farming in North-eastern U.S.A. and on the Canadian prairies. I was once more in North America from 1945 to 1950, when I had ample opportunities of seeing how American and Canadian farmers had made, and were making, full use of the new techniques and tools that science and engineering have given us in the last quarter of a century.

Have Holland, Denmark and Sweden also been able to make full use of the scientific advances of the past twenty or thirty years? How far has mechanization gone in these three countries of small farms? How is the seasonal pattern of work being adapted to meet changes in husbandry and

mechanization? When I revisited Holland, Denmark and the southern tip of Sweden in 1956, these were the questions to which I was seeking answers.

Agrarian structure

The types of farming found in southern Sweden, Denmark, Holland, and the drier half of Britain are, ecologically, very much alike. The cool, temperate climate common to these countries still largely influences the cropping and stocking of their farms, just as originally it played a basic role in forming the *relatively* uniform natural vegetation of the region. In these lands bordering the North Sea, the patterns of livestock, of crops, of rotations, of pests and of work in the field and farmstead have a decided similarity. Locally-adapted breeds and types of livestock, of crops, of grasses, and of machines—such as Friesian cattle, Large White pigs, Swedish spring wheat, Danish cocksfoot, English sugar beet harvesters—can be and are used, almost interchangeably, anywhere in the region. Over most of this area intensive mixed rotational crop and stock farming is the rule.

The agricultural policies of these four countries—and the social and economic problems on their farms—also have a great deal in common. Thus, at the present time, each country is roughly maintaining its recent volume of agricultural production and doing it with a declining labour force. Agricultural wages are of the same order—though they are perhaps highest in Sweden. Except in Denmark, support prices or other attempts to stabilize farmers' incomes are common features of the agricultural economy.

In Scandinavia and the Netherlands the basic problem is to make *full* use of the agricultural manpower on a limited area of land. This involves mechanization, which is handicapped by the shortage or the high price of capital and by the awkward and obsolete layouts of farmsteads and fields; for Denmark, Holland and the south of Sweden are characterized by small, even miniature, family farms, often made up of scattered, ill-shaped and small fields. The land is usually owned by the occupier but held within a tenure system which has little elasticity. It is not easy for the progressive farmer to enlarge the area he farms or to consolidate his fragmented holding. In this they are very unlike, for example, the highly mechanized Great Plains of North America, where the acreage farmed by a man is often only limited by his own capacity—and that of his machines.

Accent on husbandry

Paradoxically, however, it seems that these rather rigid systems of tenure—coupled with a good agricultural climate and the proximity to industrial sources of fertilizers, pesticides, etc.—have played a large part in stimulating farmers in the three countries to make full use of the advances in the agricultural sciences. The land tenure system ruled out both wholesale mechanization and the rationalization of holdings. Accordingly, farmers, their advisers and the Governments concerned have concentrated on technical husbandry improvements *within* the existing farm boundaries. They have gone a long way *without* large-scale investment in new buildings and machinery. As they could not copy the American farmer and expand horizontally, they have grown vertically. They have done this partly by intensifying their systems of production (for example, by market gardening in Holland) but largely

by raising their biological efficiency—namely, by increasing yields. Thus, according to Hamilton,* the relative productivity of grassland in nine countries surveyed by the O.E.E.C. was as follows: (United Kingdom = 100)

Netherlands	157	Western Germany	103
Denmark	133	Austria	87
Belgium	120	Ireland	83
Norway	114	France	66

Denmark, Holland and, to some extent, Sweden have in fact been more or less forced, by the rigidity of their tenure systems, to raise productivity per acre and *hence* per man, by putting the accent on bigger and better biological inputs. They depend heavily on fertilizers, pesticides and other fine chemicals and, of course, improved genes in the form of carefully selected and well-tested strains of crops, grasses and stock. The high level of their "biological" inputs is shown, for example, by the following table of fertilizer consumption:

Fertilizer usage 1954-55 (kg per hectare of agricultural land)

	N	P_2O_5	K_2O	*Total*
Denmark	25.0	29.6	47.6	102.2
Holland	80.4	47.0	62.8	190.2
Sweden	20.6	27.1	21.7	69.4
U.K.	19.5	27.0	20.4	66.4
Europe (O.E.E.C. average)	14.3	21.0	19.1	54.4

100 kg per hectare = 89 lb per acre.

The success of this husbandry policy may be clearly seen in Denmark. Here, agricultural production is only about 10 per cent above pre-war, while the consumption of fertilizer nitrogen is 120 per cent, phosphate is 40 per cent and potash is 275 per cent above 1935–39. But agricultural production† per worker is up by 40 per cent. Part of this increased output per man has been obtained by the movement of surplus labour from family farms to the towns and some by mechanization. But in Denmark, as in Holland and Sweden, it is the rise in biological efficiency that is so striking. The answer to my first question is, therefore, that there is no doubt that over the past twenty-five years these countries have successfully absorbed and exploited the husbandry advances made possible by the rapid progress of the agricultural sciences.

The same is, of course, true for Britain, although our husbandry progress may not have been as striking as that in Holland, Denmark and Sweden. We seem to have put less emphasis on improved husbandry techniques *per se*. We have had, and still have, more room for manoeuvre and more freedom of action. This is partly because our farms are bigger, and partly because our land tenure system is less uniform and, in some ways, less rigid. We have therefore been able to go further afield in our search for greater productivity. We have been able to use mechanization, not only to save labour, but also to improve our husbandry (for example, by more timely operations) and to make changes in our cropping and stocking systems.

* Paper read to the Brighton Conference on *Agriculture in the British Economy*, November 1956.

† In terms of Scandinavian food units (1 food unit = 1 kg barley).

Thus alternate husbandry is now found on some of the heavy Midland clays which were, until the coming of the tractor, more or less unsuitable for tillage, and therefore in permanent grass; the heavy wheat and bean land of northern Essex now grows a wide variety of farm and market garden crops; much traditional sheep and barley land has now become cow, corn, and kale country; milk-selling farms have climbed out of the valleys into the Welsh uplands.

Relatively few changes of this type seem to have taken place in the three countries visited. In fact, the rigidity of the cropping and stocking policy seems to be quite a problem. Thus, in Denmark, the keenness of the farmers to use new husbandry techniques is partly offset by their rigid pattern of cropping and stocking. There has been little change in their large and labour-consuming root acreage. The face of the countryside in Denmark, Holland and southern Sweden seems, over the last twenty-five years, to have changed less than it has in Britain and in the more intensively farmed areas of North America. In the United Kingdom these cropping and stocking changes have gone hand in hand not only with mechanization but also with considerable capital injection and great improvements in farm buildings, water supplies, grain drying, silage clamps, and other more or less fixed equipment.

In Holland, Denmark and Sweden there is also, of course, a trend towards mechanization and towards improved fixed equipment. But it is handicapped, as stated earlier, by problems of capital and of layout and size of farmsteads.

These countries, especially Sweden and Holland, are tackling this complex of land tenure problems by schemes designed to consolidate fragmented holdings, to settle reclaimed areas, to re-equip obsolete farmsteads, to increase farm size, etc. But these measures, like most types of land reform, are slow means of raising productivity. On the other hand, it is unwise to rely too confidently on continued progress in husbandry techniques which are, in turn, largely based on progress in the biological sciences.

Research in the husbandry of labour

In this dilemma it is not surprising to find with all three countries a lively interest in the integration of farm mechanization and farm management. Outstanding research work in this field is being done at the Institute of Agricultural Engineering and Rationalization at Wageningen, Holland. One aspect of this Institute's work—the smoothing out of seasonal work peaks so as to make more effective use of manpower—is also being studied in Denmark. The object, in both studies, is to locate the seasonal " bottlenecks " on different types and sizes of farms and then find ways of reducing or eliminating them.

This research has already provided some surprises. Thus, on some Dutch grassland dairy farms on low-lying heavy land the peak labour demand has proved to be *not* grass silage-time and hay-time, as expected, but late winter. At this season all the cattle are indoors and, in addition, weeds, etc., have to be cleared from the sub-irrigation and drainage canals and ditches. Again, daily time-sheets, kept by the farmer himself, and showing how he spends his time, have often revealed many lost hours per week and helped him to make better use of his crowded days.

Suggestions to ease seasonal labour peaks fall under three heads. The first is husbandry techniques. Simple changes, many of them already common in this country, can help to ease or spread work. Current examples are: spacing out the dates of sugar beet drilling so as to spread out singling; making tripod hay because—once it is off the surface of the land—it can be left until a slacker time; making late summer and autumn silage, etc.

The second is directed at changes in the pattern of cropping and stocking. A good example comes from Denmark. Here fodder beet and other roots occupy nearly a quarter of the acreage of crops and grass; they absorb 60 per cent of manual labour in the field and create a serious bottleneck at singling time. To reduce this root acreage and so ease the singling peak, farmers are being advised to grow winter rye for early summer silage and also kale and maize for autumn silage. In particular, they are being urged to make more root-top silage so as to get the same amount of bulky cattle feed (incidentally of higher protein content) from fewer acres under roots.

The third line of attack is, of course, mechanization. The Dutch feel that by mechanizing grass silage and haymaking, better root crops would be secured, since competition for the farmer's time and energy at singling time would be reduced. For the same reason, they are trying to develop a very simple binder so that, at corn harvest, the cows are not neglected and get milked at the proper time instead of having to wait until the daylight has gone. This Dutch and Danish research and advisory activity on Work Husbandry is obviously worth keeping an eye on.

Other potential developments in management and mechanization that I noted as worth watching were: (1) grassland management and grass handling in Holland, (2) rootcrop work and especially root-top handling and silage-making in Denmark, (3) materials handling and labour economy in and around the farmstead in Sweden and (4) overhead irrigation of grass and field crops in all three countries.

Summary

In Holland, Denmark and southern Sweden the face of the countryside seems to have changed less in the last twenty-five years than it has in Britain or in the intensively farmed parts of North America. This is not because the small farmers—who are in the majority in these countries—have not kept abreast of modern scientific developments. On the contrary, they have been at least as progressive as we have in developing and using improved breeds and strains of crops and grass and getting the best out of them by greater inputs of fertilizers, pesticides, etc., and by greater skill.

On the other hand, these countries of small—often fragmented—farms seem to have been handicapped by their land tenure system and by capital supply problems. They have not the same opportunities as we have had to mechanize, to adjust the scale of operation to suit the capital resources, to give full scope to the initiative of the progressive individual, or to change their systems of cropping and stocking to meet changes in consumer demand, in manpower supply, and so on.

This lack of elbow room has forced them to raise productivity and standards of farm living by applying the results of biological research to, and using higher fertilizers and other inputs on, traditional crops and stock.

They have improved *within* their established land tenure and *within* their pre-war cropping and stocking systems. Hence the apparently conservative face of their countryside.

This emphasis on husbandry techniques and biological advance suggests that for many years to come we may look to the Netherlands and Scandinavia for useful ideas and perhaps leadership in these fields. On the mechanization and farm management sides they have perhaps a good deal to learn from us. But there is increased interest in these countries in trying to solve the management and mechanization problems of the small farm, and we should do well to keep an eye on this research and its practical application.

Packaging Protein

BRIAN P. SPOFFORTH

Hexham, Northumberland

The popularity of pick-up balers for handling green crops is growing apace. The writer stresses their advantages in field operation and subsequently the usefulness of baled silage for feeding.

SINCE 1950, when as far as is recorded the pick-up baler was first used to speed and improve the existing methods of handling green-crop for ensiling, it has grown from strength to strength. Why? Briefly, the answers are: distant fields can be handled more economically, ease of handling from the pit, improved control of quality, more accurate rationing is made possible, operation is speeded up, and greater use can be made of existing machinery.

Before analysing these reasons for the ever-increasing adoption of the baling of green-crops, let us look generally at the sequence of operations.

Preparation of the crop for the pick-up baler is most important, as of course is its condition if high quality silage is to be produced. It should be mowed preferably when no shorter than 9 inches high. If an inside swathboard is fitted, it will deliver a compact swath, so ensuring a clean pick-up and subsequently an even feed to the baler. This simplifies its job in producing a really square bale that can be packed easily into a pit or clamp.

Most pick-up balers require a simple modification to provide a shorter bale (24 inches), and possibly a more positive feed from pick-up to bale chamber, to cope with the green, sappy crop. Naturally, the light baler with the larger diameter and robust pick-up, allied to a short unobstructed passage to the baling chamber, will be the best.

The baler may immediately follow the mower, but it is more usual to allow the crop to wilt for three to four hours before baling. If particularly wet, the bales may be left until they begin to heat before being gathered. The bales are normally carted on a low-loader trailer to the pit or side-supported clamp at the end of every day.

The site of the pit should be as near as possible to the stock to be fed, and have a practical width of about 16 feet and a slightly raked bottom to provide drainage, and vertical sides.

The packing of bales into the pit is most important. Place bales lengthwise across the pit, working from the sides to the centre. This makes it easier to cater for any slight variation in the length of the bales which may occur. Much time is saved if this is done, and it reduces to a minimum the gaps between bales; thus an even consolidation is more certain and bales more easily taken out for feeding.

Due to the consolidation already provided by the action of the baler, very little further is needed, and this is best done the following morning, so giving time for a little heat to generate and the bales to settle under their own weight.

After the first two layers are in position, the bottom temperature of 100-120°F should be reached before proceeding. Hence a thermometer is essential and regular checks should be made. The temperature is controlled either by the addition of molasses applied by watering-can to increase, or by further consolidation to decrease.

The pit must be sealed to keep out rain and air. Therefore, if it has no roof, the bales should be packed high enough above the pit sides so that after consolidation the top surface will still be above them and, with the addition of a 6-9 inch layer of loose green crop, earth and ground lime, water will run freely off the top.

Many clamps of silage are now being made in Dutch barns where the sides have been supported to prevent any chance of the tractor toppling from the top when consolidating. A Dutch barn combining a pit which has proved most successful and versatile is illustrated on p. 4 of the art inset.

Now let us analyse the reasons given for the growing popularity of making baled silage.

Distant fields handled more economically

This is due to the fact that the crop being baled into compact units of 55-65 lb enable a considerable weight of crop to be loaded on to an average sized trailer and therefore economically carted a mile or more. Such a distance would be out of the question using a buckrake loaded with loose green crop. A farmer is therefore able to use those fields too far away for his dairy stock, but by baling and carting to a pit adjacent to them he may keep them in the rotation.

Ease of handling silage from pit

If the bales are carefully placed in the pit it will be a case of last in first out on each layer of bales until the bale below is completely uncovered. Hence, the face of the pit will be in a series of steps. The bales can be lifted by their twines, which will be as strong as new provided there has been no mould to rot them. The hay-knife can be dispensed with and, if a proofed apron is worn, the bales can be lifted easily on to a trolley with no fear of contaminating the clothes. Naturally, these features make the operation more popular with the cowman.

Improved control of quality

Good silage is governed greatly by whether or not the crop is evenly compressed and, in addition, bruised and chopped a little. The baler does just this with great consistency. Then it is up to the man placing the bales in the pit to do so with care, and bearing in mind that a bale is further compressed from 18 inches to approximately 8 inches, it is easy to appreciate why there are no crevices between them.

Due to the high output of the average pick-up baler, a complete crop can be cut, baled and ensiled at its ideal state of growth.

More accurate rationing

All balers are fitted with bale counters, so enabling the operator to know exactly the number of bales he has in the pit. The average weight is quickly found, so that total quantity can be calculated. On average, a bale of 55-65 lb before ensiling will have been reduced to 40-45 lb of silage. Thus the relationship between the feeding of a known quantity and protein value can be compared with the cows' milk yield (see p. 4 of art inset).

Speed of operation

The average baler will handle a good grass crop of 6-7 tons per acre in the hour. The increased payload possible on the trailers carting to the pit helps to speed the operation. Using a bale sledge hitched to the baler streamlines the handling of the bales on to the trailer. One has been developed for operation on fairly level ground by a large firm of agricultural engineers in Carlisle. This is suitable for attaching a two-wheeled trailer behind the baler. With the addition of a chute on the edge of the bale chamber, bales are pushed straight up into the trailer hitched behind.

Greater use of existing machinery

There can be no stronger reason for persuading farmers to use the baling method. The pick-up baler has already proved itself both by its speed and efficiency of operation in hay and straw, and is now quite capable of handling the heaviest of green crops. It is only logical that with the price of machinery today and its depreciation, farmers must plan their farming to make the fullest possible use of all machines.

A few contra points

Up to now I have dealt with the "pros", but now let us study what "cons" there may be. Many farmers, due to the publicity that baled silage received in 1954-55, plunged into the job thinking that the mere fact of baling the crop would ensure good silage. But of course there is no substitute for the golden rules of silage-making: (1) keep the temperature in the pit right, and (2) keep out all water and air.

The fact that the bales must be stacked in a pit or between walls to enable them to be safely consolidated by a wheeled tractor, can incur an added

expense to build walls where there are no suitable banks into which a pit can be built. With loose silage, a clamp can be made anywhere.

For short hauls, the baler cannot equal the speed and economy of the buckrake, which has been calculated to cost 12*s*. per ton of crop ensiled in clamp in the field, as compared with an average figure of 19*s*. per ton of baled crop ensiled approximately 1 mile from the field. The cost of twine, though only 2*s*. 4*d*. per ton, can be a deterrent.

Self-feeding from a stack of bales has been tried successfully, the cows leaving the twines, which were cleared from the face twice a day.

For the future, it seems to me that farmers looking back upon their rain-damaged hay crops will turn more to silage-making and to the pick-up baler to package this protein.

Good Housing for Spring Chicken

The production of spring chicken is on the increase. This is a highly specialized and intensified form of enterprise, calling for good housing if expensive failures are to be avoided. Floor space is usually allocated on the basis of only about ¾ square foot per bird, and from day old they spend the whole of their lives in the house. Ten thousand birds are commonly housed in buildings measuring 200 feet × 40 feet.

Such concentration of birds gives rise to problems of disease control, ventilation, heating and thermal insulation. The temperature of the house must be maintained round about 60°F, so that the birds keep up an economic food conversion rate, and consequently this is the only kind of farm building housing livestock in this country where artificial heat is used on a large scale. Thermal insulation of the roof may be done by fixing various types of specialized slab-type insulation or insulating sheets immediately under the main roof sheeting. An alternative method is to provide a light insulated ceiling carried on a framework of taut fencing wire and wire netting, the ceiling consisting of wool glass resting on a layer of building paper.

Ventilation is very important—the concentration of moisture, ammonia fumes and dust in a house which is ill-ventilated has to be seen and smelt to be believed. Hopper-type windows in the walls of the house provide a useful form of natural ventilation, and it is as well to arrange that the window frames can be lifted right out. In this way the maximum amount of air can be let into the house during hot weather. The window openings should be covered with wire netting on the outside to prevent the birds escaping and to prevent rats, foxes, cats or hawks from getting in. The warm air in the house will tend to rise, so additional natural ventilation should be provided by outlet ventilators fixed in the roof. Many producers favour the use of electric fans to supplement natural ventilation, but they should have dust- and moisture-proof motors.

British Grain in Roman Times

J. R. B. ARTHUR

Littlehampton, Sussex

Historians tell us that centuries ago corn was invariably dried and stored underground. The excavation in recent years of many of these ancient drying and storage pits is gradually building up a picture of the pattern of cereal farming in Roman times and earlier.

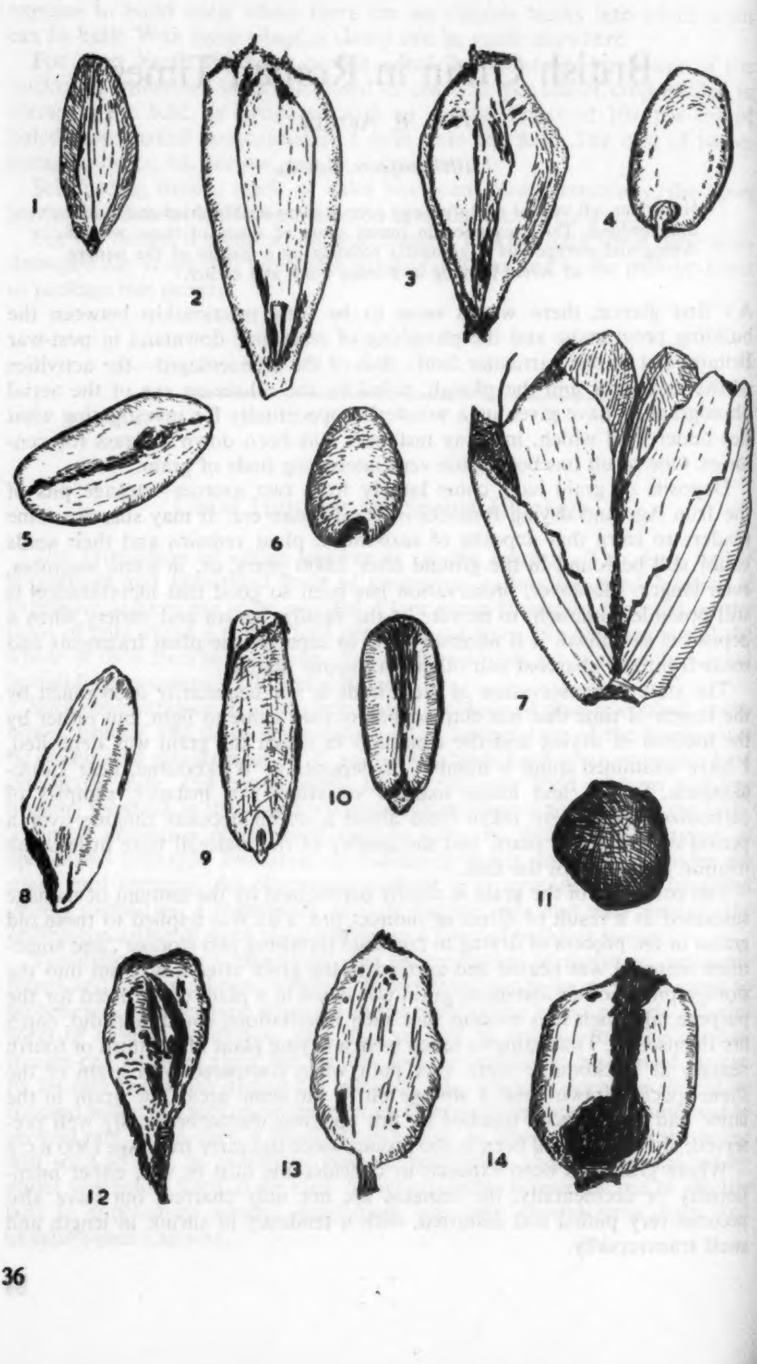
AT first glance, there would seem to be little relationship between the building programme and the ploughing of reclaimed downland in post-war Britain. But in one particular field—that of the archaeologist—the activities of the excavator and the plough, aided by the all-seeing eye of the aerial photographer, have given us a wonderful opportunity for investigating what lies under land which, in many instances, has been down to grass for centuries. One result has been some very interesting finds of grain.

Deposits of grain have come largely from two sources—storage pits of the Iron Age and drying furnaces of the Roman era. It may surprise some readers to learn that deposits of carbonized plant remains and their seeds could still be found in the ground after 2,000 years, or, in some instances, even longer. Moreover, preservation has been so good that identification is still possible, although, to be sure of the family, genera and variety when a deposit is examined, it is necessary first to separate the plant fragments and seeds from any charcoal and other extraneous matter.

The state of preservation of these finds is not necessarily determined by the length of time that has elapsed before they came to light, but rather by the method of drying and the condition in which the grain was deposited. I have examined quite a number of deposits at Wickbourne, near Littlehampton, Sussex, and found marked variation. For instance, samples of carbonized grain were taken from about a dozen deposits ranging over a period of about 700 years, and the quality of the material bore little or no relation to the age of the find.

The condition of the grain is chiefly determined by the amount of damage sustained as a result of direct or indirect fire. Fire was applied to these old grains in the process of drying to facilitate threshing and storage[1], and sometimes material was heated and applied to the grain after it was put into the storage pit. In other instances, grain was dried in a plant constructed for the purpose, although it is evident that such installations could, and did, catch fire themselves. Thus samples taken from a drying plant of the third or fourth century at Wickbourne were very poor when compared with grain of the same species drawn from a storage pit in the same area. The grain in the latter had hardly been touched by fire and was characteristically well preserved, although it had been in the ground since the early Iron Age (300 B.C.).

Where grain has been exposed to considerable heat or fire, either intentionally or accidentally, the remains are not only charred, but have also become very puffed and distorted, with a tendency to shrink in length and swell transversally.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Wheat predominates

In the particular era which I have studied—the Roman age—methods of farming were steadily improving, with the result that a large acreage of southern England was under cultivated crops, particularly wheat. Deposits therefore reveal the entire flora of the arable field, comprising not only the cultivated crops, but the many weed plants that grew alongside them. First, however, let us look at what we now regard as the four main cereals.

The wheat variety Spelt (*Triticum spelta* L.) was grown extensively in southern England for bread during Roman times, having been introduced into Britain early in the Iron Age (300 B.C.)[2]. It is thought that it was cultivated until the third or fourth century.

A feature of Spelt is its strong glumes, which hold the grains very firmly. This can be clearly seen in Fig. 7 opposite, which shows an almost complete Spelt spikelet. A Spelt grain is shown in Fig. 8. This carbonized grain, extracted from a Spelt spikelet, has preserved one or two features common to the variety—that is, a flat ventral side and the gradual slope towards both ends. The two carbonized grains shown in Figs. 4 and 5 were found loose; the puffed appearance shows the effect of over-drying[3]. Its distinctive shape, however, enables one to single out "naked wheats".

Fig. 6 is of Club or Bread wheat (*T. compactum* Host or possibly *T. vulgare* Will). Characteristically, the carbonized grain of Bread wheat is blunt at both the embryo and apex. The embryo is seen to be in a rather steep position. In fact, the grain is often widest at the embryo end, but this is by no means an invariable rule. The grain is slightly shorter than Spelt and rather more rounded[4].

Barley. The quantity of barley (*Hordeum tetrastichum*) found at East Dean, Chichester (see Fig. 3) was much smaller than that of wheat, comprising about 6 per cent of the whole, but there is ample evidence that barley was grown extensively in Britain in the late Bronze Age (500 B.C.). For example, at Itford Hill[5] in Sussex a deposit consisted almost entirely of carbonized barley. An Iron Age deposit at Fifield Bavant in Wiltshire yielded both

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Drawings of carbonized cereals and seeds taken from a Roman-British drying plant at East Dean, West Sussex (excavated by Miss Keef, 1954)

1. Oat. Naked grain
2. Oat. Flower (*Avena sativa*). (*A. strigosa* and *A. fatua* were also found)
3. Barley grain (*Hordeum tetrastichum. KCKE*) (Six Row)
4. Wheat grain. Dorsal view. (*T. spelta*)
5. Wheat grain. Ventral view. (*T. spelta*)
6. Wheat grain (*T. compactum* Host or *T. vulgare* Will)
7. Wheat spikelet (*Triticum spelta* L.)
8. Wheat grain. Lateral side. (*T. spelta*). Taken out of a carbonized spikelet
9. Rye-brome. Dorsal view. (*Bromus secalinus* L.)
10. Rye-brome. Ventral view. (*Bromus secalinus* L.)
11. Vetch (*Vicia sativa*)
12. Rye (*Secale cereale* L.)

13. } Wild radish (*Raphanus raphanistrum*)
14. }

barley and spelt[6], and in parts of Somerset barley seems to have been the principal cereal grown during the same period.

It is not certain to what extent barley was grown in Roman times. We are informed by Hans Helbaek[7] that barley plays an unobtrusive part in our finds of Roman grain, but it may be that barley was not used for bread corn by the Romans, so that they would not have troubled about drying it, thus offering us only minor opportunities for encountering it.

Oats. It is believed that when Spelt was introduced into Britain, oats also came, since we have no evidence of oats in deposits earlier than the Iron Age. But in any case no great quantity has been found, and the numerous Neolithic and Bronze Age impressions of cereals excavated in Britain do not include one single example of oats. It is questionable whether the cultivation of oats was really considered in the agricultural economy during the Roman occupation, at least in southern England. Oats have been more plentiful in mixed cereal deposits in Scotland.

In some cases, however, oats appear to have been grown with wheat. Their mixing was probably not planned but occurred because the two could not be separated. Thus in deposits where oats were more plentiful, it might be that they were grown for their insurance value[8]. This conception of mixed wheat-oat crops is confirmed by Professor J. Percival: " Grains of wheat, often accompanied by barley and oats, have been found on Romano-British and Roman sites at Cranbourne Chase, Dorset, Silchester, Hants, Richborough, Kent and Castle Cary, Stirlingshire"[9]. I believe that these were once garrison towns. The findings could easily have been grain depots, probably once filled from local farms. It is significant that these deposits were similar in content. Two recent finds of mixed cereals have been made at Falmer, near Lewes, Sussex, and at Lullingstone, near Sevenoaks, Kent. But in both cases wheat again predominated.

Numerous grains of oats were identified at East Dean (Figs. 1 and 2), although many were badly scorched. Fortunately, the base of the grain (flower) was found well preserved, even though the top part of the flower was burnt away. The Wild Oat (*Avena fatua*) was not difficult to identify, with its strong awn and oval scar. A few grains were very characteristic of the Bristle-pointed Oat (*A. strigosa* Schreb). This particular oat has been referred to by one authority as a weed of the arable field, but Professor E. T. Jones of the Welsh Plant Breeding Station, Aberystwyth, says of *A. strigosa* that it " is capable under favourable conditions of giving yields equal to that of the highest average annual yield hitherto recorded "[10].

Rye. One of the peculiarities of a deposit of carbonized rye is that nearly all the grains have germinated before drying. Many of those found have therefore been much consumed by sprouting. The effect of scorching on the grain is to make it rather shapeless. This " growing out " of grain is, of course, not confined to rye.

In the few deposits where rye has been found, it has been associated with a considerable amount of other carbonized grain. The Verulamium (St. Albans) find is the exception, since it was stated that " a not inconsiderable proportion of the grain is rye "[11]. Here again, we find spelt wheat with the occasional oat and barley.

Because rye is so seldom found in quantity in deposits of cereals, it seems that it was not of any great importance as a bread corn at this time.

Other crops

Rye Brome, now regarded as a weed of cultivated land, has been found with spelt wheat in very many deposits. It appears that no great effort was made to grow wheat free of Brome. In fact, the seed *Bromus secalinus* compares well in length and weight with, although smaller than, spelt, and it was evidently appreciated as food. The amount of Brome at East Dean was found to be over 40 per cent of the total carbonized grains, which is a higher proportion than in other finds. But yet in some other finds there is only the barest trace of Rye Brome.

When examining over-dried or carbonized Brome, it is usual to find distortions in the preserved caryopsis (groat). In Spelt we frequently have contiguous parts of the glumes (chaff) to aid identification, but this is not so with Brome, for the pales and awns which would be attached in normal circumstances have gone.

Tares. There are very few recorded instances of tares in deposits, and those found have been only single specimens. Three finds only come to mind. They were *Vicia tetrasperma* from Fifield Bavant, Wilts (Iron Age); *V. sativa* at Wickbourne (Roman Age); and *V. sativa* at Lamb Lea, East Dean, Chichester (Roman Age).

In these finds the tare is a weed. We do, however, find the small Celtic bean (*Vicia faba* L.f. *celtica* Herr) in sufficient quantity in deposits at Meare and Glastonbury, Somerset during the Iron Age to warrant the belief that it was grown deliberately. It is also believed that under Roman influence the growing of beans, by now a valued crop, was encouraged in other areas[12]. Beans were certainly found at St. Albans, Herts.

In none of the tare finds has any great distortion taken place. One explanation is that if the tare is dried, the two cotyledons separate, thus allowing the internal moisture to evaporate quickly.

Runch. Although, as far as we know, Runch has not been recorded other than at East Dean, this need only mean that the immediate area in which the deposits have been found were free from that particular weed.

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*A new series of monthly notes contributed by **Mr. J. D. U. Ward,** the well-known writer on forestry subjects.*

Month in the Forest

Fire risk—In the nursery—Frost—Selective breeding

MARCH and April are usually the two worst months of the year for forest fires. That peck of March dust which is proverbially worth a king's ransom to farmers can be a serious headache to a forester, since the fire hazard is so much increased by dry weather. Normally, a large part of the vegetation in the ground layer is dead or half dead at the end of winter, and conditions are often ideal for swaling or burning old heather and grass moors. Thus the fire risks naturally increase, since runaway moor fires are among the recognized perils which many foresters in moorland territory have to consider.

Amazing though it seems, the subject of moor-burning has apparently been very little "researched", except from the grouse or game-keepering point of view! Some work suggests that to burn once in seven or eight years might be best, but too little is known about the best widths of fire strips, about the effects of fire on the top humus layer, or indeed anything else to do with fires on moors. But there is a widespread suspicion among natural history people that farmers and holders of common rights are inclined to burn too much and too often—even from their own point of view. Certainly many of the April fires (which incidentally are illegal unless you have a licence from the Ministry) are deplorable from a standpoint of general wild life and natural history.

When a moor fire runs into a young plantation of conifers, the trees stand a poor chance. Broad-leaved trees have a better hope of survival, since so many species (including oak) will shoot again from ground level, perhaps even with renewed vigour. Indeed, fire has sometimes been used deliberately as a rough-and-ready method of "cutting back" young oak which is in check. But the idea of fire in a young plantation is, normally, a nightmare to anyone in charge, whatever the time of year. People within easy reach of south coast holiday haunts have told me how coaches sometimes stop to allow trippers to walk around and enjoy the view, and how all too often a litter of cigarette ends, including one or two still burning, remain to "mark the spot".

The whole problem is, in a sense, more difficult because nine times out of ten, in nine places out of ten in Britain, carelessness about cigarette ends simply does not matter. In this country it seems quite impossible to develop that degree of fire-risk consciousness which is taken for granted and normal all the year round in many parts of Australia or Western America. So you have to keep on nagging: "Do be careful about fire risks, won't you?"

Even those people who mean well sometimes fail. A destructive fire in Dorset two years ago was started by Boy Scouts who had doused their camp fire with soil quite nicely and "according to the book". Unfortunately, the

soil was mainly dry peat, and the fire, not completely out, took hold two days later.

In the nursery most of the ash and oak seed was sown in March. April is the month for sowing conifer seed. Tree seeds, incidentally, have an interesting range—from acorns which run about 120 to the pound, to Sitka spruce at about 200,000. Almost every kind of figure is represented in between, from beech and ash through various silver firs, pines, larches and spruces. The smaller seeds normally require only the very thinnest covering of sharp sand. At all costs a heavy hand must be avoided; no sand is better than too much, since these tiny things have not the strength to push through an unnaturally deep covering. By the same token they can't stand much scorching, and this is one of the reasons why you see so many shelters in a forest nursery: an hour of fierce sun at the wrong time may cause many casualties. When you come to think of it, the seed in a state of nature normally falls on the forest floor, which is a shady place but providing little or no covering.

April is often the most hectic month of the year in a forest nursery, not only because of seed sowing. Lining-out may still be going on, especially if there has been a hitch in earlier weeks, and the last trees (because of oversights or miscalculations) may still be going out for planting.

And there is also the worry of frosts, which can do great damage to trees which have just flushed. Not only foreign species such as Sitka spruce are vulnerable, but also our indigenous trees such as ash, beech and even oak; and this is specially true when trees are still very small. If the central leading shoot, which is the most important part, has risen, say, 4 feet above ground and is thus clear of most ground frosts, it will escape, even though seedlings may be killed.

We are all familiar with the stories about admirals in Nelson's time who used to walk around the countryside with a pocketful of acorns which they used to plant here and there. Nearly all are sentimental and admiring, but when I look round the low-class oak (normally it *is* low-class) of our countryside, I wonder did any of the well-meaning old sea-dogs study the parent trees or was *any* acorn (as I suspect) just an acorn and as good as another to their eyes? Does it surprise farmers, who have been acquainted for centuries with the general idea of genetic improvement by selective breeding from the best beasts, to know that the same principle has been widely adopted in British forestry only within the last few years? I should even guess that more has been done in the last ten years than in the previous 190 years! Scandinavian foresters have been ahead of us in these matters, yet not by a very long way—thirty years might be a fair estimate. Great improvements will be achieved by selection, but it is too soon to guess whether foresters will succeed, by deliberate breeding, in rivalling the successes scored elsewhere with farm crops and stock.

Farming Affairs

Talking about poultry

Mr. C. T. Riley, Director of the Ministry's Progeny Testing Station at Great Bookham, Surrey begins, in this issue, a series of notes on matters of general interest to poultrymen. He will, in his own words, "try to cover a £150 million industry in 500 words a month!" Current problems, new developments and perhaps notes on any interesting farm units that he comes across are the basis of his assignment.

At this moment, both the industry and the Ministry have a stake in the current season. The new Breeders' Grade Poultry Progeny Testing Stations will be hatching this month. At these centres—Harrogate, Wolverhampton and Great Bookham—320 samples, each of 100 eggs, chosen at random from Breeders' Grade farms, will have been set in March and early April. This will be the first step, on a national basis, towards the detailed progeny testing of Breeders' Grade flocks. As it will measure hatchability, rearability and egg production, the results will be of interest to all poultry-keepers. Obviously, such a scheme does not cover everyone's ideas, but its introduction is surely a landmark.

The main focus on the March-hatched chick has now passed, but large numbers are still hatched this month and it is most important to have all your rearing gear ready, especially where this equipment has been used for earlier November and January hatches. A check-over now may well save some sleepless nights later!

Going back to the October- and November-hatched pullets, these will now be coming up to lay, and here again clean housing and equipment will be needed. I expect most people will try to house them up a couple of weeks before laying, and perhaps I may be forgiven for mentioning two points on feeding which everyone knows about but which crop up every year!

In the first case, many of our birds will move into some form of intensive or semi-intensive housing, and I find that many folk do not realize what a major change this is. Generally, the birds come from "outdoors" to "indoors", the food and water are often in new containers and different places, and even the surface underfoot is changed. We must remember that if the birds have always found feed on the floor, it is there that they will look and not at troughs standing or swinging above them. I have at times seen serious loss of condition, almost starvation, in some flocks from no other cause than this, and I suggest that it pays to lower the troughs or provide crude ladders to encourage birds to seek upwards. We can expect some of these October- and November-hatched pullets to come into lay without full body size, and I feel strongly that no rationing should be attempted for the first month or two of production. During this time the bird has to grow and lay and must be fed for both jobs. Where this is not done, flocks may suddenly start into production, only to slump badly after a month or two of lay. With the present swing to some form of intensive housing, nearly all the factors concerned are those for pushing the young bird into high output quickly. There has

been a marked change in the past few years which is not always appreciated, and it is up to the owner himself to check his feed intake at this time.

At the Farmers' Club

THE MARKET FOR HOME-PRODUCED MEAT

The importance of the consumer as the final arbiter of any commodity was stressed by MR. F. W. SALISBURY in his paper to the Farmers' Club on March 6. He was speaking both as a producer and importer of meat, and as one with a long experience of the retail trade in an area of Britain in which half the total population lives.

"In any review of markets," said Mr. Salisbury, "it is as well to start at the consumer end and to work backwards. Commodities are worth just what they will fetch; the consumer is not sentimental about production costs." While we must not limit our thoughts to the home market, he continued (the rise in the world's standard of living will accelerate, and the global long-term outlook for producers offers a reasonably pleasant picture), it is the home market with which the average producer is in the short-term necessarily concerned.

Meat cannot be considered in isolation. The cash value is subject to the influences of the supply and demand ratio of other communities, and the consumer's attention can quickly be diverted accordingly.

In any field the keen producer's first and obvious question is: "What does the consumer want?" There is seldom a clear-cut answer, but what the consumer *buys* is, broadly speaking, the best indication for the time being.

A premium is usually paid for any article when demand temporarily exceeds supply, and it is not difficult to cite instances where low-grade products have commanded a higher price than those of "prime" quality. Here we strike a point of the utmost importance. Meat which is technically of low-grade, although probably less well finished, is not necessarily of lower food value than that which is technically of a higher grade. Whilst large numbers of consumers appreciate the virtues of top-grade meat, many have an aversion to fat. These and other consumer preferences may well vary considerably even among the inhabitants of the same town and certainly with the seasons of the year; obviously, it is in the interests of all that the needs of each consumer are met as closely as possible. If in the course of distribution the "lines are crossed", two quality premiums may be turned into two discounts.

Really efficient marketing, continued the speaker, should ensure the transmission of quality premiums in full to the producer who has earned them. So far as home-raised meat is concerned, the nearer the trader can get to the producer the more this is likely to be achieved. In the case of cattle and sheep, for example, the flavour of the flesh is governed by their environment in its influence on their feed, and the knowledgeable trader is thus interested in where the animal has lived and not merely in where it was killed.

"The key to the public's future assessment of meat values lies in its reaction to tenderness, flavour and the proportion of fat to lean," said Mr. Salisbury. Tenderness is a common property in imported meat, and consumers will certainly pay no more than a nominal premium for badly-produced fresh beef. Tenderness and flavour are at times difficult to combine,

as the latter develops with age, but good flavour consistently commands substantial premiums. From the point of view of palatability, the right proportion of fat is found in beef carcasses with a dressing-out percentage of sixty. Yet the public currently demands the product of a carcass with a percentage of nearer fifty-six. "Many consumers are thus not obtaining meat which they would find to be of the best flavour, and serious endeavours should be made to educate them accordingly."

Mr. Salisbury went on to say that recent adjustments affecting guarantee payments, together with the Government's long-term guarantees, present the farmer with a degree of assurance which assists him to plan ahead. At the same time, there is the need for skilled judgment to determine what to produce, when to market it and which sales outlet to utilize. And, having regard to increased consumer purchasing power, the producer must go all out for quality, and continue to do so.

In conclusion, Mr. Salisbury praised the efforts of the Fatstock Marketing Corporation to stabilize the market, and spoke of the need for even more research to assist the economic production of meat and to raise the standard of quality. The Fatstock Marketing Corporation, as a result of their research at the consumer end, will no doubt be able to tabulate much of value.

Tractor sense

We are pleased to introduce this new series of notes by Mr. H. J. Hine of the N.A.A.S. Eastern Province, whose notes "The Mechanic on the Farm" attracted so much attention in Volumes 61 and 62 of this Journal. He proposes to cover details not only of tractor driving and maintenance, but also the important aspects of related work study in farming operations.

Tractor costs make up quite a large slice of the cost of producing a field crop, and so any improvement in tractor management can mean a sizeable saving. The tractor must yield the greatest possible amount of work for the smallest possible quantity of fuel, and all the hours that the tractor is running must be useful ones, because unnecessary tractor use wastes fuel and hastens its depreciation.

The way to keep the number of tractor hours to a minimum is to plan operations ahead whenever possible. For example, before ploughing, time is well spent in considering carefully how the lands are to be laid out so as to leave as few short ends and have as little idle travelling as possible. Veering out short ends uses the plough at only part of its full working width. This is wasteful and entails many empty runs to get back into position for each bout. If the work is set out in wide lands and the plough taken round and round each opening, time is lost by idle running. By more careful planning of the tractor's route, such as by using narrower lands and dealing with two ridges as one unit, both time and fuel can be saved.

When drilling seed or spreading fertilizer, it pays to calculate, from the rate of sowing and the length of field, where bags of seed or manure can best be placed ready for refilling the hopper; but your planning must always allow for contingencies. In damp weather, for example, bags of fertilizer left scattered along the headland are likely to cake and so lead to delays more serious than the idle running when loading the distributor. In all planning of field work, the operation must be pictured as *a whole*—not as separate jobs;

and the plan must be one which will not be too greatly upset by changes in weather or other circumstances beyond your control. Remember, too, that good maintenance is a pre-requisite of good planning. A tractor which is difficult to start or which breaks down in the field can make havoc of the best laid plan.

Although the deterioration of a tractor depends on the number of hours it has been used and on the care given to its operation and maintenance, there are some factors operating whether the tractor is at work or whether it is idle. One of these is interest on capital, and another is the depreciation in value as the tractor becomes out of date, and so it is well to keep down the number of expensive tractors on the farm and to see that they are made to work for as many hours in the year as weather permits and the seasonal jobs demand. To keep the number of hours per year per tractor as near as possible to the theoretical maximum, some farmers arrange for a second driver to keep the tractor going while the regular driver has his meals and during the hours of overtime which are beyond the fatigue limit of the regular driver. In some ways this is a good thing, but it does break the very desirable principle of one tractor to one man. The relief driver will not be as used to the tractor as the regular driver, and mechanical trouble is more likely to come during these relief times than during the regular work. Breakdowns are a high price to pay for relief working—particularly where no spare tractors are available—and it is not always wise to keep the number of tractors on a farm too close to the theoretical minimum. The truth is that on most farms, large or small, an old tractor with a very low re-sale value, but kept in reasonable condition, can be an extremely useful piece of auxiliary equipment.

Radnor story

On the thin soil of a Radnorshire farm, where slopes are steep and difficult and where rainfall is high and drainage often poor, Mr. Francis Morris has, in four years, increased his profit index by 153 per cent. Average milk yield per cow has increased from 627 to 864 gallons and total milk production from 13,939 to 26,948 gallons a year. In addition, the number of breeding ewes has been increased from 125 to 308 between 1950 and 1956.

How this has been achieved is explained in a free booklet, *Radnorshire Farm*, published by Imperial Chemical Industries Ltd. The remarkable progress described is not the result of heavy capital expenditure on equipment or buildings, but of producing high quality grass for as long as possible during the year. A generous use of fertilizers (Mr. Morris's bill in the four years 1951–55 increased from £403 to £572) and good management of the extra grass produced, has meant that (expressing all stock in "cow equivalents") the farm now carries one cow to every 1¾ acres of grass and fodder crops, including those on the steep slopes. At the same time, the average yield of corn has been more than doubled, chiefly as a result of the fertility built up by intensive management of the sward.

Prejudice dies hard, particularly in hill farming areas, but inspection of Mr. Morris's farm evokes nothing to support dismal prophecies for high farming or for the generous use of fertilizers.

In Brief

IT PAYS TO STORE POTATOES INDOORS

"There is no doubt that it pays well to store potatoes indoors wherever there are buildings capable of being used or adapted for this purpose," says Mr. R. Bennett Jones in the University of Nottingham's *Farm Management Notes No. 16*. The University has been studying the question of building and handling costs over the past two or three years, and discussions with farmers who have adopted indoor storage have confirmed that the fears of delay at harvest time arising from the need to transport the potatoes from field to store are largely imaginary. An extra tractor and trailer to keep the work moving smoothly will be necessary on some farms.

Once the potatoes are in the insulated buildings, the labour saving begins to appear. Under a proper layer of straw the potatoes can be left until riddling begins. Clamps, by contrast, have to be earthed up. The cost for this varies greatly, but 2*s*. per yard run is a common piece-work rate. Riddling costs also vary widely, but the Nottingham figures suggest a saving of 2*s*.–3*s*. a ton for riddling from stores, as compared with riddling from clamps. So far as these investigations have gone, the total cost savings in handling charges arising from indoor storage are of the order of 4*s*. 6*d*. per ton. This is enough to pay the cost of using existing or adapted buildings.

There is also the aspect of convenience and comfort and other items which cannot readily be determined on a basis of cash saving. As Mr. Bennett Jones rightly says, "Farmers and their workers like tractors because they don't have to be fed at weekends. They prefer riddling potatoes in warm buildings to doing the same job in an exposed, wind-swept, muddy field. Whether it "pays" or not, the omens are that indoor storage will rapidly gain popularity. Certainly we have still to hear of any farmer, with experience of indoor storage, who prefers the traditional method of storing in clamps."

AGRICULTURE BILL

The Agriculture Bill, which was laid before Parliament on March 7, provides for the new long-term assurances for agriculture and for the new scheme of grants for assisting the provision of permanent fixed equipment and the making of long-term improvements to land. It also provides for the establishment of a Pig Industry Development Authority to improve the technical efficiency of the pig industry in Great Britain and for certain other matters.

The intention under the long-term assurances is that the guaranteed price for each commodity and the total value of the guarantees (allowing for cost changes) will be kept at not less than a certain percentage of their value in the previous year. This part of the Bill also provides a more permanent basis for the guarantee arrangements for the various commodities and for the measures necessary to support those arrangements.

The farm improvement scheme will offer grants for farm improvements and amalgamations, to be available for ten years, up to a maximum of £50 million. There is also provision for extending this period to 12 years and the amount to £55 million if Parliament approves. The rate of grant will be 33⅓ per cent and, with limited exceptions, all the main permanent improvements not already covered by grant will be eligible.

REDUCING EVAPORATION

A new chemical process to reduce evaporation from dams and reservoirs is being developed in Australia by the Commonwealth Scientific and Industrial Research Organization. The process, known as the Mansfield process, uses beads of an insoluble chemical known as hexadeconal, which floats on the surface of the water and is anchored on a special raft to prevent it from blowing away. A very thin invisible film spreads from the beads over the surface of the water, and this in turn restricts evaporation.

From extensive tests which have been carried out in different parts of the country, it is estimated that the process will save a quarter of the water being held in dams and reservoirs.

PH OF SOIL AND SILAGE

Our scientists and advisers commonly refer to "pH" when describing the degree of acidity (or alkalinity) of a soil or a sample of silage. But what do they mean?

A simple explanation which would satisfy the scientist is impossible, but without going into the complexities of logarithms and chemistry, it can, for all practical purposes, be described as a convenient scale ranging either side of a neutral point, which is indicated by the number 7. Readings below 7 show an acid condition, and readings above point to an alkaline condition. Thus a reading of 7.5 would indicate "weakly alkaline" and, lower in the scale, 4.5 would indicate "fairly acid". Each pH unit is, in ascending order, ten times less acid than its predecessor. Thus pH 4 means an acidity ten times greater than pH 5, and pH 9 is ten times more alkaline than pH 8.

Living things are very sensitive to pH outside a given range, and plants differ widely in their tolerance of soil acidity. Rhubarb, Yorkshire fog and the weeds spurrey and sorrel will tolerate a good deal; other crops like rye, potatoes, oats and alsike clover are not quite so tolerant, while sugar beet, barley and lucerne prefer a neutral status, or one only slightly on the acid side—say, pH 6–7. In this country it is rare to find soils of a pH greater than 8.5, but some farm soils may be as low as 4.5: moorland soils may fall to 3.5 or less. In making silage, we encourage the lactic acid bacteria to grow quickly and so produce a pH of below 4, which is much too acid for the putrefactive bacteria to tolerate. Such silage has a light, bright appearance and an attractive smell.

The symbol "pH" was invented in 1909 by a Danish chemist called Sorensen. The "p" standing for *potenz* (=power), the "H" for hydrogen ion, which, in the opinion of scientists, is the cause of acidity.

OFF THE BUCKET

How do *you* get your calves off the bucket early? You may put dry meal into the calf's mouth, put it on the animal's wet muzzle or dust it into the bottom of the milk pail. Another way is to mix the grain feed with warm water immediately liquid milk feeding is stopped. T. R. Preston of the Rowett Research Institute reviews the whole subject of early weaning in the current issue of the *N.A.A.S. Quarterly Review*. He says that at the Institute they are not in favour of such time-wasting stratagems, but rely rather on absolute hunger by abrupt weaning. The few calves that fail to eat meal before weaning invariably do so within a very short time after milk is dis-

continued. Group feeding has been found to stimulate "competition" around the feed trough and so induces greater consumption of meal. Run in small groups, one calf teaches the other to eat.

In individual pens, calves learn more quickly to eat dry food from buckets than from troughs, probably because they associate buckets with milk. Providing water in a bucket adjacent to the meal also improves meal consumption, since the young calf alternates frequently between eating and drinking.

MCPB AND MCPA ON CLOVERS

Some useful information about the relative effects on clover and weeds of the new weedkiller, MCPB, was given to the recent Weed Control Conference. This chemical is now widely used for undersown corn crops besides the standard herbicides MCPA and 2,4-D.

MCPB is not, as some people have thought, completely without effect on clovers. It does check them to some extent, though it is quite safe if makers' recommendations are followed. It is only about one-eighth as toxic to white clover as MCPA, but about one-third as toxic to red clover. In other words, a rate of application of 2 lb per acre of MCPB (approximately the normal rate of application) will have roughly the same effect on white clover as ¼ lb MCPA, and on red clover as ⅔ lb MCPA.

If these amounts of MCPA and 2,4-D will adequately control the main weeds concerned, there is no advantage in using the more expensive MCPB. There are, however, only one or two important weeds, such as charlock and runch, for which such a low rate as ¼ lb MCPA would be as useful as the standard rate of MCPB, and for white clovers there is generally a strong case for the use of the new compound.

For red clovers, MCPB is less selective than for white, and the amount of MCPA which is as safe for them as the standard rate of MCPB—that is, about ⅔ lb per acre, is quite sufficient to give a reasonable degree of control of quite a number of weeds. With red clovers, the only weeds for which MCPB gives a decided advantage, are those for which the two materials are nearly equally effective. These include (of arable weeds) corn buttercup, sow-thistle, black bindweed, fumitory, redshank, docks and creeping thistle. For other weeds, a low rate of MCPA (about one-third the normal rate) would be equally effective on the weeds and just as safe for the red clover.

LESS WORLD WHEAT

Less wheat was produced in the world last year, according to figures issued by F.A.O. in February. Total production in 1956–57 (excluding Eastern Europe, the Soviet Union and China) is likely to be 121 million metric tons —some two million tons less than in the previous twelve months.

Efforts by the United States and Canada, the two major stockholders and producers, in 1956, to reduce production, were defeated by high yields. But, on the other hand, in Western Europe the increased harvests in the United Kingdom, Scandinavia, Western Germany, Spain and Portugal failed to offset the heavy crop losses caused by late frosts in France, and reduced production in Belgium and Italy.

Annual Review, 1957

The White Paper (Cmnd. 109)*, published March 21, describes the production progress made by the agricultural industry during the past year; the changes in income and costs; the Government's production and guarantee policy; the price guarantees determined for livestock and livestock products for the year April 1957 to March 1958, and new price guarantees for crops from the 1957 harvest to supersede those determined after the 1956 Review; and some changes in production grants. A new feature of this year's Review has been the long-term assurances announced in November 1956 (Cmnd. 23), by which the Government have undertaken (i) to maintain the total value of the guarantees at not less than 97½ per cent of their total value in the preceding year, after allowing for cost changes that have occurred on review commodities since the last annual review; and (ii) to maintain the guaranteed price for each commodity at not less than 96 per cent of that determined after the preceding annual review.

Agricultural output is estimated to have risen from 56 per cent above pre-war in 1955–56 to 59 per cent above pre-war in 1956–57, largely as a result of a rise in the output of livestock products, and notably of milk, eggs and beef. Actual net income for 1956–57 is forecast at £317 million, compared with £325 million for 1955–56. Adjusted for normal weather conditions, these estimates become £334 million for 1956–57, about equal to the highest previously recorded in 1952–53, compared with £306½ million in 1955–56.

The Government have reviewed production and guarantee policy in the light both of domestic considerations and of the country's international trading position, especially in relation to the Commonwealth. The major objective continues to be that production should be more economic. This calls for a selective expansion of net output with the main emphasis on the substitution of home-grown feedingstuffs, including grass, for imports, and on economies generally in the use of imported materials. The maintenance or expansion of net output can in the Government's view best be achieved by: (i) maintaining a large arable acreage, of something like the current size, but with more emphasis on feed crops; (ii) relying to a greater extent, for the maintenance of a large livestock population, on home-produced resources; and (iii) producing more good quality beef and lamb, but no more milk, eggs, pigmeat or wheat. Indeed less milk and eggs than the quantities at present in prospect are needed.

The total cost of agricultural support during 1956–57—about £245 million—is appreciably greater than in 1955–56—about £205 million. Present indications are that this total is likely to rise further.

The national economic situation has required that the Government should take a strict view of the needs of the industry. After considering all relevant factors, including the effects of the long-term assurances and the need to enable the industry to continue to play its full part in the national economy, the Government have decided to increase the total value of the guarantees by some £14 million. In the Government's opinion this will enable the industry to maintain its progress in improving efficiency and to secure a reasonable level of remuneration for economic production, and at the same time accord with the present stringent requirements of the national economy.

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* H.M. Stationery Office, price 1*s.* 3*d.*

TABLE OF GUARANTEED PRICES

Important Note: For the bases of the prices given below and other particulars of the guarantee arrangements, see the Additional Details of Guarantees in Part II of Appendix V of the White Paper (Cmnd. 109).

LIVESTOCK and LIVESTOCK PRODUCTS

Commodity	Guaranteed Prices 1956–57 as determined after the Annual Review, 1956	Price change compared with the 1956 Annual Review guarantee	Guaranteed Prices 1957–58 as determined after the Annual Review, 1957
Fat Cattle (per live cwt)	151*s*. 0*d*. steers, heifers and special young cows	+5*s*. 0*d*.	156*s*. 0*d*. steers and heifers only
Fat Sheep and Lambs (per lb estimated dressed carcass weight)	3*s*. 2*d*.	+ 1¼*d*.	3*s*. 3¼*d*.
Fat Pigs (per score deadweight)	49*s*. 7*d*. (subject to a reduction of 1*d*. per score in Gt. Britain) related to a feed price of 31*s*. 2*d*. per cwt under the existing feedingstuffs formula	No change	51*s*. 11*d*. (subject to a reduction of 1*d*. per score in Gt. Britain). This guaranteed price is related to a feed price of 31*s*. 5*d*. per cwt under the revised feedingstuffs formula
Eggs—hen (average per doz.)	4*s*. 1½*d*. (subject to a small reduction in Gt. Britain)	− 1½*d*.	4*s*. 1½*d*. (subject to a small reduction in Gt. Britain)
Eggs—duck (average per doz.)	2*s*. 4½*d*. These prices were related to a feed price of 29*s*. 8*d*. per cwt under the existing feedingstuffs formula	− 1*d*.	2*s*. 5*d*. These guaranteed prices are related to a feed price of 29*s*. 10*d*. per cwt under the revised feedingstuffs formula.
Fleece Wool (average per lb)	4*s*. 8½*d*.	No change	4*s*. 8½*d*.
Milk (average per gal.)	3*s*. 2.45*d*.	+ ¼*d*.	3*s*. 2.70*d*.

CROPS

Commodity	Guaranteed Prices for 1956 Harvest as determined after the Annual Review, 1955	Price change compared with the 1955 Annual Review guarantee	Guaranteed Prices for 1957 Harvest as determined after the Annual Review, 1957
Wheat (average per cwt)	29*s*. 9*d*.	−1*s*. 2*d*.	28*s*. 7*d*.
Barley (per cwt)	26*s*. 0*d*. which, adjusted to the new basis, would have been 28*s*. 6*d*.	+ 6*d*.	29*s*. 0*d*. (on new basis)
Oats (per cwt)	24*s*. 9*d*.	+2*s*. 8*d*.	27*s*. 5*d*.
Rye (per cwt)	23*s*. 0*d*.	− 11*d*.	22*s*. 1*d*.
Potatoes—ware (average per ton)	217*s*. 0*d*.	+8*s*. 0*d*.	225*s*. 0*d*.
Sugar Beet (per ton, 16.5 per cent sugar content)	128*s*. 1*d*.	+2*s*. 5*d*.	130*s*. 6*d*.

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Book Reviews

Rural Rides. RALPH WIGHTMAN. Cassell. 18*s*.

The alternative title of this book, *Rural Rides with Ralph Wightman through Cobbett's England*, gives a reasonably accurate idea of its theme. Ralph Wightman's millions of admirers will already be familiar with much of the material, broadcast in a series of B.B.C. programmes and now presented in book form.

It makes a better book than might have been expected—in fact, a delightful, homely and yet very sage book—and this is chiefly because Ralph Wightman looks out of every page. We find him inspecting not only Cobbett's England but, more particularly, present-day England, which is much more interesting.

Anyone who expects to find resemblances between the attitudes of Cobbett and Wightman towards rural affairs will be disappointed. Cobbett was a fiery prophet, calling attention to impending ruin and hurling the blame for it at every public figure in sight. Wightman is the tolerant Shakespeare, commenting amiably on the passing scene. Cobbett, campaigning against terrific odds for his beloved and distressed countryside, is an heroic figure that commands our admiration, but we feel more at home with the comfortable Ralph.

This is doubtless because English farming today *is* more comfortable than it was in 1821–32, when Cobbett conducted his celebrated rides through the shires. Then the collapse of the war against Napoleon caught the nation unawares and heralded a monumental economic disaster. If Wightman had made his tour in 1926-28 he would have found parallel conditions calling, perhaps, for passion similar to Cobbetts. As it is, World War II has not been followed by what would seem to be the inevitable consequences of a world conflagration. Wightman shrewdly suggests the reason: ". . . possibly we are not yet at the end of the 1939–45 war. . . . As I followed Cobbett to Burghclere in 1954, the mad prosperity of war was still providing full employment."

He is content to report on things as he finds them, without falling into the temptation of tilting at windmills in order to emulate Cobbett. He sees and comments on order, grace, and a reasonable measure of prosperity flourishing in a countryside which Cobbett thought was doomed. He admires the restored glory of Ely cathedral and records conflicting views on the new synthetic town of Crawley. Above all, he meets people—scores of them. And it is surprising how many links with Cobbett's day they can forge for him. Time and again he discovers that the farmers, shepherds, smallholders and housewives with whom he has been talking are direct descendants of the people whom Cobbett knew at the same place a hundred and thirty years ago. Such is the abiding continuity of life in rural England.

R.W.

The Garden Controversy. (Studies in Rural Land Use—Report No. 2). R. H. BEST and J. T. WARD. Department of Agricultural Economics, Wye College. 3*s*.

Napoleon once called us a nation of shopkeepers, but we have truly become a nation of gardeners. The national characteristic of the British to live in a house with a garden may cause large encroachments to be made on farmland which would otherwise be used for the production of food. In order to conserve this land, Government policy tends to increase the density of housing, thus making gardens smaller.

However, as this report points out, about 14 per cent of a garden in an average housing estate is devoted to the cultivation of vegetables and fruit, and the proportion of gardens cultivated for food increases as the density of housing falls. As about 66 per cent of an average house plot could produce vegetables and fruit, it would be possible to increase output from gardens during times of national emergency.

This is a very useful booklet, as it summarizes the various surveys which have been made on this controversial problem and brings to light the potential for food production which exists in the house-gardens and allotments of the country. The only criticism I have is the attempt which the report makes to relate the

money values of food produced from an acre of house-gardens with an acre of farmland. Admittedly, the value of the horticultural produce from gardens may be greater than that of, say, wheat from a similar area of farmland. But we need milk, meat and cereals, which gardens do not produce, in greater quantity than fruit and vegetables. The report ignores this fact.

A.J.E.

Cider Fruit Production. (Pamphlet No. 24). A. POLLARD. Bath and West and Southern Counties Society. 2*s*.

At the end of the nineteenth century the Bath and West and Southern Counties Society started investigations into cider and cider fruit production. Later the work was transferred to the Long Ashton Research Station, but the Society have always maintained their interest in the cider industry and have published this report by the present head of the cider section of the Station.

Dr. Pollard endeavours to draw together a lot of information from many sources and present a picture of the past and present cider apple production record and associate this with the needs of the cider industry. Reports and statistics are quoted to show the changing face of apple production and the decreased acreage of cider orchards. Present trends in cider-making and the demand for cider are dealt with at some length, and there are a few paragraphs on the future prospects of the industry. We shall probably see, very shortly, the need for a changed accent in apple production. Growing apple trees is a slow job and if more apples are needed quickly these may well have to come from renovated orchards for a while.

The views of the research worker are necessarily a little conservative, but in the past the cider and cider apple work at Long Ashton has been largely of a pioneer character. With the acceleration of the cider industry, the position is likely to change and more pioneering will be done by the leaders of the industry, leaving the research workers to solve the more academic problems involved.

Copies of the pamphlet are obtainable from the Bath and West and Southern Counties Society, 3 Pierrepont Street, Bath.

J.E.F.

An Apology

Farm Buildings: Conversions and Improvements (February issue, p. 551)

Incorrect reference was made in this review to "the late Edwin Gunn". We are happy to say that Mr. Gunn is very much alive—as his prompt (but friendly) reaction to the mistake testified. We have already tendered our sincere apologies to Mr. Gunn and are glad to take this further opportunity of correcting the mistake.

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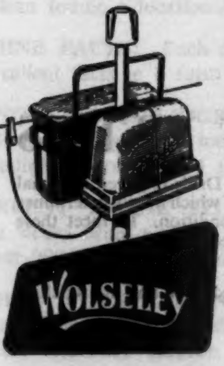

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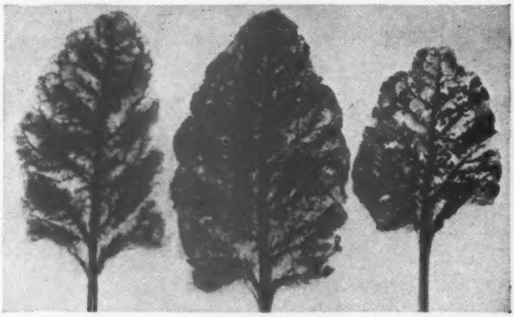

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